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WHEAT VARIETY TRIALS IN THE SOUTH ISLAND.

SEASON 1933–34.

Fields Division, Department of Agriculture.

IN the 1933–34 season twenty-nine wheat-variety trials were conducted in Marlborough, Canterbury, and Otago in collaboration with and on behalf of the Wheat Research Institute. The main project was the comparison of Cross 7 (Solid-straw Tuscan × White Fife), bred by the Wheat Research Institute, with Solid-straw Tuscan. Of twenty-six such trials laid down, twenty-five were harvested, while two out of three experiments in which other varieties were compared with Solid-straw Tuscan were harvested.

Most of these trials were laid down by the Beaven half-drill-strip method, at the suggestion of Dr. Hilgendorf, using farmers' drills. The arrangement of plots resulting was as follows : 1, 2, 2, 1, 1, 2, &c., where 1 and 2 represent the different varieties under trial, there being ten replications of each variety.

A standard rate of seeding of 2 bushels per acre of each variety was used. One hundredweight of superphosphate per acre was sown with the seed in all trials.

TRIALS WITH CROSS 7.

Milling and baking tests by the Wheat Research Institute have shown a fairly consistent and appreciable superiority of Cross 7 over Solid-straw Tuscan, and its yielding-capacity is the subject of further trials during this season. Its whole performance—yield, milling and baking qualities—will be reviewed by the Wheat Research Institute before supplies of seed are made available to growers. It is anticipated that seed will be available for next season's sowing.

Particulars of dates of sowing and harvesting and results of each individual trial in the 1933–34 season are given in Table 1. Observations during the growing period of the crops are summarized as follow :—

1. *Tallness.*—Generally, Solid-straw Tuscan was taller and more vigorous than Cross 7, more particularly in the early stages.

2. *Date of Maturity.*—Cross 7 ripened earlier than Solid-straw Tuscan in the majority of trials. No attempt was made to harvest each variety at its optimum stage of ripeness, and as harvesting was carried out when the later maturing variety was in fit condition the Cross 7 had, in most cases, been ripe several days when the crops were cut.

In Experiment 14 (for location, see Table 1) both varieties had ripened some weeks before being cut, as adverse weather conditions had prevented earlier harvesting, but no shaking occurred. The crop was cut and threshed on the same day.

3. *Lodging.*—In four trials (Nos. 1, 20, 21, and 22) it was reported that Solid-straw Tuscan showed a greater tendency to lodge than Cross 7. In trial No. 1 Solid-straw Tuscan was badly lodged in patches while Cross 7 was standing up well. In two others (21 and 22) lodging of the Tuscan would have been much more severe had it not been for the support rendered by the adjacent plots of Cross 7.

4. *Loose Smut.*—Cross 7 was reported to be more badly affected with loose smut than Tuscan in eight (8, 10, 16, 17, 18, 19, 25, and 26) of the trials, while in one experiment (1) this position was reversed.

Table 1.—Yield in Bushels per Acre and Differences from Solid-straw Tuscan in Trials with Cross 7.

NOTE.—Differences in heavy type are statistically significant.

Number and Location of Trial.	Date Sown.	Date Harvested.	Yield in Bushels per Acre.		Difference in favour of Solid-straw Tuscan (+) or Cross 7 (−).
			Solid-straw Tuscan.	Cross 7.	
1. Smith Bros., Tuamarina ..	18/5/33	4/1/34	43·4	59·1	−15·7*
2. M. Walsh, Omaka	19/5/33	27/12/33	32·3	31·4	+0·9
3. G. R. Page, Glasnevin ..	20/6/33	20/1/34	11·2	10·7	+0·5
4. D. Morgan, Cheviot	23/5/33	19/1/34	56·0	49·7	+6·3
5. A. R. Hislop, Amberley ..	13/6/33	20/1/34	24·2	21·8	+2·4
6. K. L. Wilke, Culverden ..	13/6/33	17/1/34	21·2	23·6	**−2·4**
7. G. H. Cross, Oxford	30/6/33	27/1/34	24·9	31·4	**−6·5**†
8. High School, Rangiora ..	21/6/33	24/1/34	47·6	46·9	+0·7
9. C. Rands, Springbank ..	25/5/33	17/1/34	28·1	28·8	−0·7
10. C. G. Amyes, Fernside ..	28/8/33	2/2/34	27·6	21·8	**+5·8**
11. F. Carpenter, Prebbleton ..	19/5/33	26/1/34	29·9	27·2	**+2·7**
12. R. T. McMillan, Irwell ..	15/6/33	18/1/34	26·9	25·8	+1·1
13. D. Mulholland, Darfield ..	22/5/33	1/2/34	28·2	26·1	+2·1
14. W. R. Oliver, Hororata ..	9/6/33	25/2/34	34·5	38·2	**−3·7**
15. L. O. Oakley, Rakaia ..	20/6/33	1/2/34	32·7	32·7	0·0
16. J. Ruddenklau, Methven ..	26/6/33	5/2/34	37·5	42·3	**−4·8**
17. A. Amos, Wakanui	16/6/33	27/1/34	34·3	32·9	**+1·4**
18. H. A. Harrison, Dorie ..	13/6/33	2/2/34	24·6	19·7	**+4·9**
19. Mrs. Hall, Lyalldale	21/6/33	16/2/34	34·3	35·6	**−1·3**
20. A. B. Timblick, Hilton ..	14/6/33	14/2/34	27·5	25·5	+2·0
21. I. A. Marshall, Tycho ..	9/6/33	20/2/34	54·2	52·6	+1·6
22. J. C. Hay, Morven	10/6/33	15/2/34	57·7	52·0	**+5·7**
23. J. Newlands, Ngapara ..	9/8/33	24/2/34	55·5	62·1	**−6·6**‡
24. R. B. Paton, Pukeuri (A) ..	9/5/33	10/2/34	29·3	26·5	+2·8
25. R. B. Paton, Pukeuri (B) ..	18/5/33	10/2/34	28·0	25·9	**+2·1**
Lincoln College	..	..	44·8	43·4	+1·4

* Plots not threshed separately so that statistical examination was not possible. As stated in the text Solid-straw Tuscan lodged badly in places and a large amount of pinched and immature grain was left in the straw at threshing. Tuscan was also frosted to some extent.

† Although statistically significant, this difference may have been influenced by damage to stooks resulting from lambs gaining entrance to the paddock.

‡ The yield of one Cross 7 plot was about 45 per cent. better than the adjoining Solid-straw Tuscan plot, suggesting error. Apart from this plot, however, there was a consistent superiority of Cross 7, and omitting it the difference was still about 4 bushels.

It is not clear whether any importance should be attached to the greater incidence of loose smut in Cross 7, as the seed of Cross 7 used in these trials has never been treated for loose smut, while the Tuscan seed used was only once removed from treatment with hot water.

5. *Resistance to Shaking.*—In spite of the fact that Cross 7 was invariably ripe for some days before being cut loss of grain through shaking was recorded in only three experiments (8, 12, and 13). In these cases loss of grain occurred in both varieties.

6. *Straw-break.*—Heavy winds just before harvest caused a certain amount of straw-break in some of the trials. In three trials (15, 16, and 20) the straw-break was more severe on the Solid-straw Tuscan plots.

COMMENTS ON TABLE 1.

A trial carried out by the Wheat Research Institute at Lincoln College is included in the table for purposes of record. Out of the twenty-six experiments six gave results significantly in favour of Solid-straw Tuscan, and six in favour of Cross 7. In one or two of the remaining trials considerable variation in yields between individual plots of the same variety caused quite appreciable differences in favour of Solid-straw Tuscan to be non-significant. Excluding the result of Experiment 1, which was quite abnormal, due to the lodging of the Tuscan, the average difference in favour of the latter in the twenty-five remaining trials was 0·7 bushels per acre.

MISCELLANEOUS VARIETY TRIALS.

Other varieties were compared with Solid-straw Tuscan in four experiments, two of which were in conjunction with the Cross 7 trials. The yields of these are shown in Table 2.

Table 2.—Yield in Bushels per Acre and Differences of Miscellaneous Varieties from Solid-straw Tuscan.

NOTE.—Differences in heavy type are statistically significant.

Number and Location of Trial and Varieties.	Date Sown.	Date Harvested.	Bushels per Acre.	
			Yield of Variety.	Difference in favour of Solid-straw Tuscan (+) or Variety (−).
22. J. C. Hay, Morven—				
Solid-straw Tuscan ..	10/6/33	15/2/34	58·3* 56·3†	
Dreadnought 5/27 ..	10/6/33	15/2/34	70·6	**−12·3**
College Hunter's II ..	10/6/33	15/2/34	70·1	**−13·8**
25. R. B. Paton, Pukeuri—				
Solid-straw Tuscan ..	18/5/33	10/2/34	28·0	**+2·9**
College Hunter's II ..	18/5/33	10/2/34	25·1	
26. C. G. Amyes, Fernside—				
Solid-straw Tuscan ..	28/8/33	25/1/34	26·3	
Jumbuck	28/8/33	18/1/34	26·4	−0·1
27. G. McGregor, Milburn—				
Solid-straw Tuscan ..	8/9/33	6/3/34	47·8	
Jumbuck	8/9/33	20/2/34	38·7	+9·1‡
Marquis	8/9/33	21/2/34	44·4	+3·4‡
Solid-straw Velvet ..	8/9/33	6/3/34	48·2	−0·4‡

* Plots adjacent to Dreadnought 5/27. † Plots adjacent to College Hunter's II. ‡ Yields not examined statistically.

COMMENTS ON TABLE 2.

Experiment 22.—Solid-straw Tuscan was badly affected with mildew and both Dreadnought 5/27 and College Hunter's II stood up to the extremely wet conditions prevailing better than did Solid-straw Tuscan.

Experiment 25.—Hunter's II was affected with Hessian Fly and there was more straw-break in this variety than in the case of Solid-straw Tuscan.

Experiment 26.—Owing to a misunderstanding at sowing, Jumbuck was treated with Ceresan New while Tuscan was treated with copper carbonate. These facts must be taken into consideration when comparing the yields as Ceresan New is reputed to have a beneficial effect on yield. Jumbuck suffered severe shaking in four replications. Omitting these the average yield in favour of Jumbuck (not significant) was 2·9 bushels per acre.

Experiment 27.—When cut Jumbuck was over-ripe and it was estimated that about 20 per cent. of the seed was lost as a result of bird attack. Marquis was cut in good condition but Solid-straw Velvet and Tuscan were not so ripe as the other two varieties when cut.

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THE NORTH TARANAKI PASTURE COMPETITION.

REVIEW FOR SEASON 1933–34.

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THE judging of the pasture competition organized by the joint committee representing the Taranaki Agricultural Society and the Farmers' Union has now been completed, and once again this phase of the competitions has been very successful.

Its popularity among the various districts in North and Central Taranaki can be gauged by the increased entries and the increased interest displayed. The following figures indicate the growth of the pasture classes since their inauguration in 1930 :—

TABLE OF ENTRIES.

District.	Season.			
	1933–34.	1932–33.	1931–32.	1930–31.
Urenui	24	22	17	10
Inglewood	6	2	12	17
Huirangi	8	7	12	11
Kaimata	4	3	11	6
Lepperton	8	9	7	4
Tikorangi	7	7	10	2
Okato	9	5	20	..
Toko	10	8	5	..
Tarurutangi	7	8	8	..
Wharehuia	15	16	..	..
Omata	3	4	..	..
Hurworth	..	2	..	..
Oakura	11	..	..	..
Hillsborough ..	3	..	..	..
Totals	115	93	102	50

The adoption of two judgings (spring and autumn) as introduced during the preceding season was adhered to, it being recognized that a pasture to be a good one should produce all the year round. The ideal pasture would be one where there was a thick sward of good grasses giving the same growth each month of the year. That this can never be achieved is obvious, but we can attempt to achieve it, and in so doing give our pastures a longer season of growth, which will be greatly to our advantage. If judging could be carried out each month a fairer allocation of points could be made as regards seasonal growth, but this also is impracticable, and we find that the two judgings give quite a good indication of the season's growth. As was the case last year the autumn was very favourable to pasture growth, and consequently there is very little difference in many cases between the points awarded in the spring and those given in the autumn. However, the mere fact that it was a good autumn intensified the problems of grass management as far as utilization is concerned, and it was possible to indicate to farmers generally the advantages of controlled grazing during a season of abnormal growth. As an indication of what this management might involve, one might point out the fact that the leading pasture was topped with the mower twice during the summer, while another extremely good sward was mown three times during the summer months.

In viewing the pasture competitions this season some farmers have voiced the opinion that increased production following better pasture work will be a bad thing in view of existing markets, &c., but this is a very short-sighted view to take. The cry of reducing our production costs is heard throughout the land to-day, and there is no cheaper method of producing butterfat than by grassland farming, so that

increased butterfat as a result of better grassland farming must result in a reduction of the production costs. There is at least one farmer in North Taranaki to-day (and there are doubtless others) who through good grassland farming is producing butterfat at less than 6d. per pound, an indication that with good grassland farming a profit can be shown even at present prices.

The judging was again carried out by observation and points allotted to various features of the pastures as under: good grasses, 30; clovers, 25; freedom from inferior grasses, 5; freedom from weeds, 10; denseness of sward, 15; evenness of sward, 15: total, 100. While this scale of points is not altogether free from anomalies, it appears to serve the purpose quite well. With regard to the various features indicated, some further explanation is probably necessary. Under the heading "Good Grasses" the percentage in the sward of such grasses as perennial rye, cocksfoot, timothy, dogstail, *Poa trivialis*, prairie, meadow foxtail, and paspalum is noted and also the condition of these species. For instance it is of little value having numerous rye or cocksfoot plants present in the sward if they are not of a leafy strain or not in a healthy vigorous condition giving much feed, and likewise a pasture containing 100 per cent. of good grasses may be one low in production if these grasses are all in a rank unpalatable state. So under this heading we look for a sward composed chiefly of the good grasses indicated in a strong healthy condition, well controlled, and growing much palatable, nutritious feed. The same remarks apply to the points awarded for clovers: here a variety of clovers such as white, red, subterranean, and alsike, in a healthy growing condition and of a good leafy type, is desirable. Many of the Taranaki pastures contain much inferior grass such as sweet vernal, *Poa pratensis*, hair grass, rank fog, and *Danthonia*, with suckling clover and inferior *Lotus*, so that the points allotted for "Freedom from inferior grasses" indicate the presence or absence of these species. It is claimed by some that five points is not sufficient for this feature of a pasture, but it must be remembered that if a pasture is full of these inferior species it cannot contain a large amount of good grasses, so that the points for "Good grasses" must suffer considerably. The points allotted for freedom from weeds need little explaining, except that they indicate a great weakness in our pastures. Plantain, catsear, and other flat weeds occupy too great a proportion of our pasture land, and are the means of greatly reducing our average butterfat production per acre. If a pasture becomes bad with flat weeds the struggle against them is a long arduous one, so that it behoves us to endeavour to establish the pastures without them and keep them out. This can be done by the better preparation of the seed-bed, the sowing of better strains of grasses and clovers, and the increasing of the fertility by putting manure in with the seed, and by subsequent early top-dressing. The "denseness" of the sward is an extremely important feature of the pasture. A pasture viewed from over the fence often looks very fine, but when it is crossed it is found to be very open in the bottom and perhaps only half of the ground actually covered. This means that without any increase of interest rates, living-expenses, and maintenance the production of that paddock could be doubled if the ground could be covered. This could probably be achieved by sowing a better strain mixture of grasses in the first place, or by better grazing and top-dressing subsequently. The last points are given for evenness

and utilization. A good pasture must be one where grazing is well controlled. It is an accepted theory that the production from 100 lb. of controlled Yorkshire fog would exceed that of 100 lb. of rank rye or cocksfoot, so that when one looks on the condition of a pasture with this knowledge in mind one immediately sees the advantages and necessity of controlled grazing (or its equivalent in topping) in the interests of economic production. This feature is particularly prominent in the autumn judging, and particularly where paspalum, in a substantial quantity, is present in the pasture. Paspalum is a good autumn grass, and a paspalum pasture, provided it is comparatively well supplied with rye and clovers, must score well, providing it is kept under control.

An interesting fact is the improvement that has been noted in the pastures judged over the last four seasons. This has in many instances been the direct outcome of the competitions.

It is generally assumed that it is only the best pastures that are entered in these competitions, but this is not always so, as quite a number of farmers enter a paddock of average (or perhaps lower than average) production with a view to determining whether it is improving or deteriorating under his particular system of management. All competitors are asked to give certain particulars in connection with their pastures, and the following information is gleaned from these particulars :—

Acreage of Paddocks.—The average acreage of all paddocks entered was 6·9 acres, the actual sizes being : 14 fields of 3 acres ; 14 of 4 acres ; 23 of 5 acres ; 16 of 6 acres ; 8 of 7 acres ; 8 of 8 acres ; 1 of 9 acres ; 14 of 10 to 15 acres ; 3 of 15 to 20 acres ; 1 of over 20 acres.

This indicates that as far as this district is concerned subdivision is fairly good, and this is a big factor in controlled grazing. Naturally the size of the paddocks will depend upon several factors, the principal one of which will be the size of the herd. As an indication of how the smaller paddock, or to put it in another way, the one of heavier carrying-capacity with its better grazing, results in a better pasture, might be quoted the size of the various paddocks in relation to the size of the herds. In this connection the competitors are grouped in tens, and the number of cows per acre quoted, indicating the size of the paddocks in their relation to the size of the herd : Ten best pastures carried 13·1 cows per acre ; second ten, 9·41 ; third ten, 9·76 ; fourth ten, 11·92 ; fifth ten, 10·21 ; sixth ten, 9·33 ; seventh ten, 11·05 ; eighth ten, 9·63 ; ninth ten, 7·84 ; last ten carried 7·7 cows per acre.

Age of Pastures.—The average age of the pastures entered was twelve years, the individual entries being : 3 to 7 years old, 21 entries ; 7 to 10 years old, 13 entries ; 10 to 15 years old, 35 entries ; 15 to 20 years old, 16 entries ; over 20 years old, 17 entries.

One of the conditions in connection with the pasture competition is that the pasture must be at least three years old. Of the pastures over twenty years old some were probably thirty or forty years old, being sown prior to occupancy by the present farmer. The average age of the first ten entries was 11·8 years, showing that some of the oldest pastures in Taranaki are amongst the finest.

Time of Sowing.—Details were available in seventy instances, and of these fifty-four were sown in the autumn and sixteen in the spring. Of the sixteen sown in the spring thirteen were in inland districts (Toko

and Wharehuia), and this indicates the practice common in Taranaki of sowing down in permanent pasture on the coast in the autumn and inland in the spring.

Quantity of Seed per Acre.—This amount varied from 15 lb. to 65 lb. per acre, with the largest number of sowing between 40 lb. and 44 lb. Details are : 15 lb. per acre, 1 entry ; 20 lb. to 30 lb., 2 entries ; 30 lb. to 40 lb., 4 entries ; 40 lb. to 44 lb., 26 entries ; 45 lb. to 49 lb., 19 entries ; 50 lb. to 54 lb., 4 entries ; 55 lb. to 59 lb., 2 entries ; 60 lb. to 65 lb., 9 entries.

It is significant that the first three pastures were sown at the rate of 60 lb. per acre. However, to-day, with our improved grass strains and better seed generally, there is not the necessity to sow so heavily ; but one must remember that weed control depends largely upon the obtaining of a quick grass cover, and the heavy sowing certainly brings this about expeditiously. However, with a good seed-bed and with the seed well sown, 40 lb. to 45 lb. per acre should suffice. Actually, if every seed germinated and survived 15 lb. per acre would be ample.

Manure with the Seed.—It is common practice in some districts not to sow manure with the seed, but this is not recommended, except where sowing-down is following the grazing-off of such a crop as rape. Unless there is abundant fertility in the surface soil the seedling plants will be slow to establish, and flat weeds will gain a footing. Superphosphate alone was most generally used, although the addition of green bone or bonedust, and perhaps a little lime to the mixture, would be an advantage. Details are : No manure, 5 entries ; superphosphate, 26 ; green bone, 9 ; bone and super, 8 ; bonedust, 1 ; basic super, 2 ; slag and super, 2 ; proprietary, 4 ; rock phosphate, 2.

Subsequent Top-dressing.—The manures used on the grassland varied somewhat with the different types of soil met with. It should be remembered that these pastures are situated in various places from heavy river flats to light loamy uplands, so that any one system of manuring successfully used could hardly be universally adopted. Details of top-dressing for the past three seasons were recorded, and are as follows :—

Kind of Top-dressing.	Season.		
	1931.	1932.	1933.
Basic slag	49	25	18
Superphosphate	26	18	20
Lime and super	4	15	19
Super and slag	5	6	3
Basic super	3	3	1
Ammoniated super ..	2	2	1
Phosphate and potash ..	3	6	6
No manure	7	10	15
Proprietary	2	10	13
Rock phosphates	..	2	1
Super and bone	..	4	4
African phosphate ..	3	1	..
Farmyard manure ..	..	..	2

The swing from slag to other manures is undoubtedly the result of financial conditions, which make the unit of phosphate in slag 5–5 as against 3–8 in the case of super, and it is rather remarkable that eighteen used slag in 1933. This proves to what extent those farmers have faith in slag as a grass-producer. The increase in the use of lime and super is also an indication of the times, this being apparently considered an economical manure. The number of farmers who used no manure at all is rather alarming, while the increase in the users of potash is significant. There is little doubt that were prices for produce better, half the farmers in North Taranaki would be using potash, and profitably, too.

Quantity of Top-dressing applied.—The quantities applied varied from about 2 to 7 cwt. per acre, as follows :—

Quantity per Acre.	Season.		
	1931.	1932.	1933.
2 cwt. ..	4	4	9
3 ,, ..	74	63	53
4 ,, ..	14	18	17
5 ,, ..	2	2	2
6 ,, ..	1	3	3
7 ,, ..	0	1	2

In practically all cases where over 3 cwt. was applied two applications were made, one in the autumn and the other in the spring or summer.

Types of Harrows used.—There are a large number of makes of grass-harrows in use in Taranaki, and a number of them do very good work. Some are inclined to be a little too severe unless worked under very exacting conditions, but, on the other hand, many are not effective, due sometimes to the make but most generally to neglect in cleaning frequently. Whilst our knowledge in connection with harrowing for grassland cultivation is not very extensive, we do know that all harrowing that spreads the animal droppings is beneficial. To get a satisfactory spread, the harrows require to be fairly severe to pick up the dried dropping which is often overgrown. With the falling-away in top-dressing much good work can be done to counteract the result by paying more attention to proper harrowing. The following harrows were found to be in use: Tripods (make not stated), 34; chains, 7; Perfect, 11; Reid and Gray, 3; Taylor, 9; Wilson, 3; Whakatane, 8; Duncan, 2; tines on tops of chains, 10; Boothmac, 9; Evona, 3. The number of times the various pastures were harrowed is as follows: 1 stroke, 25 entries; 2 strokes, 27; 3 strokes, 26; 4 strokes, 7; 5 strokes, 3; 6 strokes, 1; 7 strokes, 3; over 7, 2; no harrowing, 9 entries.

Carrying-capacity.—Some additional statistics for this season were in connection with the acreage on the whole farm and the size of

the herd, and the details of these are quite interesting. For instance, they show that on the smaller farms the carrying-capacity is highest, indicating that on these smaller farms more care and attention can be given to proper pasture-management with very beneficial results. It might be argued that these small farms are all on good land, and that this accounts for the higher carrying-capacity; but actually nearly every district represented in the competitions has one or two small farms, so that the effect of any district differences can be discounted. The following table indicates the number of acres per cow on the farms of various sizes: Up to 50 acres, 1·75 acres per cow; 51 to 75 acres, 1·94; 76 to 100 acres, 1·95; 101 to 150 acres, 2·15; over 151 acres, 2·16.

In connection with these carrying-capacity figures, it should be stated that those farms embracing sheep-farming as well as dairying have not been considered, the figures relating to straight-out dairy farms only.

The Relationship of the Rest of the Farm to the Competition Paddock.—It is sometimes stated that competitors in the pasture competition concentrate unduly on the competition paddock, and that therefore it is no indication of the farm or the farmer's ability. This may possibly be so in some isolated instances; but as an indication that in a general way the better carrying-capacity farms usually appear well up in the list may be cited the following table, where the competitors have been grouped according to the points they received and the average carrying-capacity of each group stated: Competitors gaining over 180 points, 1·92 acres per cow; 175 to 179½, 1·99; 170 to 174½, 2·06; 165 to 169½, 2·03; below 164½ 2·33.

The champion pasture for the 1933–34 season was that of Mr. F. Smith, Tarurutangi, which gained 186¾ points. This pasture was very strong in rye-grass, timothy, dogstail, and white clover, although a little weak in cocksfoot. However, as the summer growth of rye-grass was so outstanding, the lack of cocksfoot was not a serious matter. The freedom from weeds and the denseness and evenness of the sward were outstanding features of this pasture. The paddock was 5 acres in extent and fourteen years old. It was sown in the autumn with 60 lb. per acre of seed and top-dressed as follows: 1931, 3 cwt. slag; 1932, 3 cwt, slag and super; 1933, 3 cwt. slag and super; 1934 (January), 1¼ cwt. super, 1¼ cwt. slag, and 58 lb. sulphate of potash. During the past season the pasture has been harrowed nine times and rolled once, and was topped with the mower in November and again in January.

Mr. F. Goodin, Okato, filled second place, this same pasture being second to Mr. D. L. Tate last season. Considering that this was a fairly big paddock, and that nothing was done to it in the way of preparing it for the competition, the paddock is really outstanding. There is a splendid sward of rye-grass and good grasses, and the sward is dense and even. This paddock has been slagged for the past eight years with 3 cwt. of slag annually. It was harrowed four times, and although only 7½ acres in extent grazes 120 cows when being fed off.

Mr. G. F. Mehrtens, of Inglewood, filled third place with the pasture that has always been well up the list. This is an outstanding rye-grass paddock, although a little weak in other species. The paddock is 7 acres in extent, and the pasture thirteen years old. The top-dressing for the past three years has been 450 lb. lime and super; 4 cwt. slag; and 350 lb. of blood and bone/super.

Mr. J. N. Blyde, Lepperton, filled fourth place with a fifteen-year-old pasture, 3½ acres in extent. The last three years' top-dressing has been: 1931, 1 cwt. 30 per cent. potash, 2 cwt. super (summer), 3½ cwt. slag (winter); 1932, 1½ cwt. 30 per cent. potash, 2 cwt. super (summer), and 3 cwt. lime and super (winter); 1933, 2 cwt. super (spring), 2 cwt. potash, 3 cwt. super (summer), and 3 cwt. of lime in June; 1934, 1½ cwt. 30 per cent. potash and 2½ cwt. super (summer). This paddock was also topped three times this season and was harrowed three times.

"SORE-SHIN": A VIRUS DISEASE OF BLUE LUPINS.

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DURING the past three years a disease, for which the name "sore-shin" is suggested, has been prevalent in blue-lupin crops in various parts of New Zealand. This disease, which ultimately causes death of infected plants, has been observed in Hawke's Bay, Taupo, Taranaki, Manawatu, Wairarapa, Nelson, Canterbury, and Otago. The incidence is usually greatest where successive crops are grown for green manure. At the Plant Research Station Area, where "sore-shin" has been troublesome each season, 100 per cent. of the plants in one plot became infected, while in other localities infections up to 50 per cent. have been reported.

SYMPTOMS.

The first visible symptoms of the disease are a slight stunting of the plant, associated with the characteristic curling of the growing point to one side (Fig. 1). Simultaneously, a light-brown streak appears on that side, extending the whole length of the stem. Growth ceases with the appearance of the first symptoms of the disease. On cutting, the vascular system of infected plants shows a brown discoloration, which is more extensive in the roots and growing-points than on the main stem. The discoloured area subsequently extends until the whole stem become brown.* The young leaves at first wilt (Fig. 2) and then turn black, while the older ones become tinged with purple, turn yellow, and ultimately fall (Fig. 3). The stem turns black, the roots decay, and finally the plant dies. Infection takes place at all stages of growth, being observed in seedlings 4 in. tall and mature seeding plants.

* Dark-brown lesions often appear on the stems of infected plants about ground-level. These are caused by saprophytes, which have gained entrance after the initial virus infection.

FIG. 1. EARLY SYMPTOMS OF "SORE-SHIN" ON INOCULATED LUPIN PLANTS GROWN IN THE GLASSHOUSE. HEALTHY PLANTS ON LEFT.

[*Photo by H. Drake.*

Determination of the Causal Organism.

Since no references to this disease could be found in the available literature, experiments were undertaken to determine its cause. These consisted of (1) isolations from infected material; (2) inoculation of isolants into healthy lupin plants; (3) experiments on soil reactions; and (4) tests for the presence of virus.

Many isolations were made from the vascular system of stems and roots, and also from stem lesions. Bacteria were frequently, but not always, isolated from the discoloured vascular tissues, while both bacteria and a *Fusarium* sp. (*Elegans* section) were associated in lesions on the stems.

Inoculation Experiments.

In each of the following experiments seed, which was collected from "sore-shin" free plants, was sown in sterilized soil in an insect-proof glasshouse or cage. The plants were allowed to remain in the house for about two months after planting. At this stage they were approximately 5 ft. tall.

INOCULATIONS WITH BACTERIA.

(*a*) *Wound-inoculations.*—Forty plants when 6 in. tall were wound-inoculated just above ground-level with bacteria from plate cultures. One plant developed the disease, while all the rest remained healthy.*

(*b*) *Inoculation of Germinated Seed.*—Eighty seeds were germinated on the surface of the soil under a sterilized cloth cover. Before the young plants had taken root they were lifted, rubbed on agar-plate cultures of bacteria, and then planted. None of these plants developed "sore-shin."

(*c*) *Seed-inoculation.*—Eighty lupin-seeds were dipped in a suspension of bacteria and then sown. No sign of the disease appeared in any of these plants.

As a control to the above inoculations eighty untreated lupin plants were grown under similar conditions. These all remained healthy.

INOCULATIONS WITH FUSARIUM SP.

(*a*) *Wound-inoculations.*—Forty plants when 6 in. tall were wound-inoculated as above with *Fusarium* isolated from "sore-shin" infected plants. None of the plants developed the disease.

(*b*) *Soil-inoculations in the Glasshouse.*—Forty 4 in. pots of sterilized soil were sown with three seeds per pot. Before covering, a suspension of mashed cultures of the *Fusarium* was poured over the seeds contained in twenty of the pots. The remainder were left uninoculated. All plants remained healthy throughout the growing period.

* In preparing the bacterial cultures for these inoculations, small portions of discoloured tissue from infected plants were placed on culture media in petri dishes. In making inoculations the bacteria, in some cases with a piece of the original stem tissue, were removed with a needle and inserted in a wound at the base of the stem. In the light of later experiments, it would appear that infection of this particular plant was caused by the accidental transference of a virus-infected portion of tissue from the petri dish.

FIG. 2. LUPIN PLANT SHOWING WILTING OF YOUNG LEAVES AND CURLING OF GROWING POINTS CAUSED BY THE "SORE-SHIN" VIRUS.

[*Photo by H. Drake.*

(*c*) *Soil-inoculations in Insect-proof Cage.*—On the 22nd March, 1932, sixteen boxes of sterilized soil were inoculated with agar-plate cultures of the *Fusarium* isolated from infected plants. Two boxes were left uninoculated. Three boxes were dressed with burnt lime at the rate of 1, 3, and 8 tons per acre respectively on the following dates: 8th April, 1932, 9th May, 1932, 21st July, 1932, and 22nd September, 1932. Four boxes remained unlimed. On the 22nd September, 1932, each box was sown with ten lupin-seeds. No "sore-shin" developed in any of the plants.

INOCULATIONS WITH DISEASED TISSUE OF INFECTED PLANTS.

(*a*) *Soil-inoculation in the Glasshouse.*—Infected lupin plants were cut 6 in. above ground-level and the stems crushed and buried in boxes of sterilized soil. Sixty seeds were sown in this inoculated soil. No infection occurred on any of the plants.

(*b*) *Soil-inoculation in Insect-proof Cage.*—On the 22nd March, 1932, sixteen boxes of sterilized soil were inoculated with mashed diseased blue-lupin roots, while two boxes were left uninoculated. The same dressings of burnt lime were applied as described above, four boxes were left unlimed, and each box was sown with ten blue-lupin seeds on the 22nd September, 1932. No "sore-shin" developed in any of the plants.

Seed Transmission of the Disease.

Seed was collected from infected plants in the field, and on the same day 160 were sown in sterilized soil in the glasshouse. Although the germination was low (72 per cent.), the plants which developed remained healthy throughout the growing period.

Field Experiments with Lime and Fertilizers.

Two one-tenth acre plots which had been in potatoes the previous season were used for this experiment. One was dressed with ground limestone at the rate of 2 tons per acre, and the other at 1 ton per acre. Each plot was divided into sixteen sections, and on each of the following dates, 8th April, 1932, 5th May, 1932, 12th July, 1932, and 20th September, 1932, three were dressed with burnt lime at the rate of 1, 3, and 5 tons per acre respectively. The remaining four sections in each plot were not treated. All were sown on the 21st September, 1932, with blue-lupin seed in drills 2 ft. apart, the seed being spaced 1 ft. apart in the drills. In each section the following fertilizers were sown with the seed in duplicate drills: Basic slag, 3 cwt. per acre; superphosphate, 3 cwt. per acre; and super-burnt-lime mixture (50–50), 6 cwt. per acre. Four drills in each section were sown without fertilizers.

On the first inspection, made when the plants were 9 in. tall, infected plants were found throughout the plots, their location bearing no constant relation to the amount or date of liming, or to the fertilizers. At this time all the infected plants were removed. On the second inspection, the plants then being 18 in. tall and showing flowering heads, a further series of diseased plants were removed. These occurred in every section and with all

manures. No plants were removed on subsequent inspections. By mid-January, when the seed was ripening, practically every plant showed symptoms of the disease.

The adjoining land to these plots had been used for experiments on Sclerotinia-disease of blue lupins for the previous two seasons,

FIG. 3. ADVANCED STAGE OF "SORE-SHIN" INFECTION ON LUPIN PLANT TAKEN FROM THE FIELD. HEALTHY PLANT ON RIGHT. [*Photo by H. Drake.*

and "sore-shin" had occurred sporadically. On this land an autumn-sown strip of lupins, in which numerous cases of "sore-shin" were present, adjoined the plots used in the above experiment, being separated from them by a pathway 4 ft. wide.

Determination of the Virus Nature of the Disease.

From the foregoing experiments it appeared that none of the organisms isolated was the primary cause of the disease. The symptoms and manner of spread suggested that the condition might be due to a virus. The virus nature of any disease may be proved by reproducing the symptoms on a healthy plant either (1) by transference of insects which have fed on the diseased plant, or (2) by artificial inoculation with juice extracted from diseased material. The following experiments were carried out to determine whether "sore-shin" was brought about by a virus.

EXPERIMENTAL METHOD.

Lupins were grown in pots of sterilized soil in an insect-free glasshouse. The source of inoculum was in each case "sore-shin" infected plants from the field. These plants were ground in a mortar and the juice strained through muslin. Inoculations were made by rubbing the leaves of healthy plants with muslin moistened with the undiluted juice. The roughness of the material caused tiny scratches and bruises on the leaves, thereby allowing the juice to come in contact with the living tissue. In the earlier experiments, inoculations were carried out on lupins about 9 in. tall, but later it was found more satisfactory to inoculate plants when about 12 in. tall.

RESULTS OF INOCULATIONS.

For the first experiment eighteen plants were inoculated and the same number left as controls. Two inoculated plants developed typical symptoms of the disease, while all the controls remained healthy.

A further experiment was carried out using twenty-six plants for inoculation and fifteen for controls. Of the twenty-six inoculated plants, seven developed the disease while the control plants remained healthy. In a third experiment forty-five plants were inoculated and fifteen left as controls. The plants were observed daily, and the first symptoms appeared on some plants on the tenth day after inoculation. An inspection made three weeks after inoculation showed that twenty-four of the inoculated plants had developed typical symptoms of the disease. All uninoculated plants remained healthy.

In the three experiments a total of eighty-nine plants were inoculated, and of these thirty-three (or 37 per cent.) developed the disease. No "sore-shin" developed in the forty-eight plants used as controls.

These experiments indicate that "sore-shin" is a virus disease, which is apparently not seed-borne. Experiments on insect transmission are now being undertaken, and results will be published in another article.

Summary.

(1) A disease, herein termed "sore-shin," is recorded as being prevalent on blue lupins in New Zealand.

(2) The symptoms of the disease are discoloration of the vascular tissues, wilting of the young leaves, decay of the roots, and ultimately death of the plant.

(3) Isolations from diseased material yielded bacteria and a *Fusarium* sp., which when inoculated into healthy plants failed to reproduce the disease.

(4) Virus inoculations, consisting of leaf-rubbing with juice from infected plants, reproduced typical symptoms on thirty-three out of eighty-nine plants.

(5) No disease appeared in 115 plants grown from seed collected from infected lupins.

SOME MISCONCEPTIONS ABOUT LUCERNE.*

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PROBABLY no other crop available to New Zealand farming has associated with it so many valuable potentialities and so many vital misconceptions as has lucerne. Of course, grassland exceeds it in national importance and possibly also in unexploited potentialities, but the basic misconceptions that attach to lucerne fortunately do not attach to grassland. As these misconceptions are the primary cause of the unexploited potentialities of lucerne, some consideration of them seems worth while.

One of these misconceptions relates to the status of lucerne. It is believed by many that lucerne is still under trial and that it would be as well to let others take any risk involved in the trials that are needed. Actually lucerne is well past the experimental stage in New Zealand. Experience with lucerne has extended over many years and over many conditions. The experience has been ample to indicate that a much greater area could profitably be sown in lucerne in New Zealand. And it has been varied enough to provide information about where lucerne may and may not be sown with reasonable prospects of attractive returns. Hence, provided work with lucerne is based upon the best available knowledge, no unknown risk need be taken.

The area in lucerne in New Zealand is relatively small. For instance, it is substantially less than the area in lucerne in England and Wales, which, in turn, are of much less area than New Zealand. England, incidentally, has had experience with lucerne since the seventeenth century, so that lucerne can hardly be looked upon as a "new" crop. Further facts which enable comparisons to be made relative to lucerne exploitation are: (1) The live-stock industry of Canada is slightly greater than that of New Zealand; its lucerne area is thirteen times as great. (2) The live-stock industry of Argentina is about five times as great as that of New Zealand; its lucerne area is 632 times as great. While it does not follow necessarily that New Zealand should make lucerne as prominent in its farming as the countries just mentioned, it would certainly seem that New Zealand should give more consideration to the potentialities of lucerne.

* Substance of a lecturette broadcast from Station 2YA.

It is gratifying that official returns show that lucerne is steadily increasing in popularity in New Zealand. Since the first time lucerne was recorded as a separate crop, seven seasons ago, the area in lucerne has increased 30 per cent. The figures for the year ending the 31st March last are not available, but during that year the sales of cultures by the Department were sufficient to treat the quantity of seed required for the sowing of over 6,000 acres, so that a further substantial expansion in the Dominion acreage of lucerne may be expected.

A vital misconception about lucerne is that it is costly to establish. Actually under ordinary circumstances the cost of establishing an acre of lucerne and that of sowing down the same land in permanent pasture are practically equal. In the first place, as to the cost of material, the current prices in the Wellington Province are—

For 1 Acre of Lucerne: 15 lb. of seed, £1 8s. 9d.; 1 ton of lime, 13s. 6d.; culture, 1s.: total, £2 3s. 3d.

For 1 Acre of Permanent Pasture: 25 lb. perennial rye-grass, £1 13s. 9d.; 10 lb. cocksfoot, 15s.; 3 lb. timothy, 2s. 3d.; 3 lb. dogstail, 3s. 9d.; 3 lb. red clover, 3s. 9d.; 2 lb. white clover, 4s. 2d.: total, £2 2s. 8d.

In the second place, the preparatory cultivation and manuring needed for the one in general would serve equally well for the other. Suitably located, lucerne as a rule lasts as a profitable crop for many years—in fact, it becomes practically as permanent as many pastures that are designed to be permanent. But should the life of the lucerne be limited to five or six years, as it occasionally is, then the initial cost of establishment spread over so many years is but a slight overhead charge relative to the good returns that successful lucerne gives. In view of the data just given, the origin of the belief that lucerne is exceptionally costly to establish remains somewhat obscure.

A misconception that deters many from sowing an area in lucerne is found in the belief that it is specially exacting in its requirements. Curiously, a contradictory misconception is involved in the occasional practice of selecting for lucerne an inhospitable area of ground—at times one which is worn out or which is gravelly and dries out badly in the summer, and which will support no other crops satisfactorily.

Relative to the requirements of lucerne in respect to soil, the position in New Zealand is briefly that lucerne has been grown successfully on practically all types of well-drained soils except peaty ones.

Undoubtedly on deep, fertile, open, well-drained soils lucerne gives the best results, and lucerne is of such intrinsic merit when successful that it should be allotted soil of this nature when at all possible. Good surface drainage and underdrainage are both necessary. If the land available is not highly fertile, it should be made so by suitable treatment. Lucerne culture in Central Otago rather well illustrates the correlation between soil fertility and success with lucerne. Ten samples taken as typical of the different Central Otago soils contained on the average over 2½ per cent. of lime and nearly 2 per cent. of potash. These figures represent an unusually heavy

soil supply of lime and potash, and the analyses revealed further that the soils were naturally rich in phosphates. The marked success which characterizes lucerne in Central Otago may be linked definitely with the richness of the soils in important minerals, as indicated by the figures just mentioned. Some seem to incline to the belief that lucerne is suited only for relatively dry climatic conditions such as would occur, for example, in localities of less than 30 in. of rainfall. This belief that the usefulness of lucerne is restricted to relatively dry conditions arises probably from the fact that the merits of lucerne are apt to be particularly emphasized under dry conditions. For instance, when droughty conditions prevail in Canterbury, Marlborough, or Hawke's Bay, then it is that the special value of an area of lucerne becomes particularly apparent, for under such conditions lucerne is likely to be the only crop making fresh vigorous growth. But New Zealand experience has definitely shown it is unsound to hold that the use of lucerne should be restricted to the drier farming areas. In proof of this it need be mentioned only that for years thousands of acres of lucerne have given markedly profitable returns in Taranaki, one of our wettest provinces, and that numerous highly profitable areas of lucerne are to be found in parts of the Auckland and Wellington Provinces in which the rainfall is well in excess of 30 in. a year.

In this connection the principal distribution of lucerne in New Zealand is interesting. In round figures there are 6,000 acres in the Auckland and Gisborne districts, 4,500 acres in Hawke's Bay, 5,000 acres in Taranaki, 3,000 acres in Wellington, 5,000 acres in Canterbury, and 9,000 acres in Otago. The New Zealand experience as to the adaptability of lucerne conforms with the experience of other countries. As an illustration of this, Circular 35 of the Californian Agricultural Extension Service states :—

"The type of soil is of little importance, provided it is deep and friable enough to permit the ready penetration of water and plant-roots, and is well supplied with the mineral elements necessary for plant growth, especially lime, phosphorus, and sulphur. Good drainage is also necessary. . . . The soil should, in addition, be well supplied with organic matter or humus, although excellent yields have been obtained on soil deficient in this constituent."

A belief that is accorded fairly wide acceptance is that lucerne when satisfactorily established requires so much attention as to be of questionable value compared with other crops that can be employed satisfactorily with much less attention. In one respect successful lucerne does call for much labour annually. In many districts it is likely to involve not only a cutting for ensilage, but also two to four other cuttings for hay or green feed. In brief, in its harvesting it often requires as much labour as a series of many other crops ; but to object to it on this account is parallel action to that of a not over-energetic farmer who remarked that one should to some extent be thankful for a drought, because it resulted in much less work at harvest-time.

But it is a distinct misconception to consider that, apart from harvesting, a great deal of attention in the form of cultivation always needs to be given throughout the year to lucerne. It is a misconception which arises from advice without much basis in

practice which is at times voiced. The following statements from the Department's bulletin on lucerne indicate briefly the position: "Principally as a means of reducing the competition of weeds, cultivation of lucerne is at times well worth while. For such cultivation to be of value it is essential, firstly, that the lucerne be not greatly damaged and, secondly, that the cultivation be done under the conditions which will most greatly reduce the competition of weeds. . . . As a rule, a suitable time for such cultivation is after the second or third cuts; the dry weather then experienced assists in the destruction of the weeds. . . . Cultivation under relatively wet or cold conditions is an unsound practice."

From these statements it may be deduced that indiscriminate or drastic cultivation may do more harm than good, and that winter and spring cultivation is often likely to be inadvisable. There is evidence that many failures of lucerne have been brought about, usually in a gradual way, by unnecessary or injudicious cultivation. If the cultivation is severe enough to dislodge weeds, then each time it is carried out it is practically sure to destroy some lucerne plants, and eventually the crop may become so thinned as not to be worth while. In brief, cultivation of lucerne should not be looked upon as a routine practice. It should be based on an intelligent interpretation of the requirements of a crop—certain crops may not need cultivation; other crops may need cultivation which, to be valuable, requires to be done at definite seasons. Usually winter and spring cultivation is inadvisable.

Some mistaken practices lead to but brief profitable lives for stands of lucerne that under good management would be successful for many years. One of these practices is failure to top-dress suitably for the purpose of providing fertility, which at the beginning may not have been high enough to give maximum returns from lucerne, and which is depleted relatively rapidly in the removal of crops of hay, silage, and green feed.

Another of the practices which in most districts tend to shorten the profitable life of lucerne stands is grazing. The consolidation caused by the grazing favours such plants as grasses and clover, which often compete injuriously with lucerne.

A practice which is likely to weaken lucerne if it is in competition with plants which make growth earlier than it in the spring is deferring the first cut of the season longer than is necessary. This, which is likely to occur when the first cut is utilized not for ensilage but for haymaking, prolongs the harmful competition of the invading plants.

A further practice which will quickly weaken lucerne is mowing too frequently during the growing season—*i.e.*, mowing before the crop is sufficiently mature. This and other matters which have been considered and lucerne culture generally are discussed at considerable length in Bulletin No. 155 of this Department, which is available for free distribution.

It is deemed advisable to discuss at this season the matters mentioned above mainly because, if preparatory cultivation for new areas of lucerne has not already been started, it should, as a rule, be commenced at an early date.

LIVE-STOCK POISONING IN NEW ZEALAND.*

B. C. Aston, Chief Chemist, Department of Agriculture.

Frequent cases of poisoning in live-stock have made it desirable that the matter should be considered in all its bearings, and to this end the following account has been compiled. It embodies the result of over thirty years' experience in investigating suspicious mortality in live-stock with a view to the detection of poison in the animal or the food upon which it had fed.

It may be accepted that domestic stock, including animals of all kinds, poultry, fishes, and invertebrates, such as bees, may be the subject of inquiry, and these may have eaten or otherwise absorbed poison which caused their deaths, and that these phenomena may be conveniently classified under four headings, chosen for the sake of convenience rather than on any strictly scientific ground: (1) Inorganic or mineral poisons or preparations used for destroying unwanted forms of life, (2) indigenous poisonous plants, (3) wild exotic poisonous plants, and (4) cultivated exotic poisonous plants.

Mineral Poisons or Preparations.

Under the first heading should be included all poisonous metallic compounds such as those of arsenic, lead, antimony, phosphorus, mercury, as well as of organic compounds such as the cyanides and hydrocyanic acid, strychnine, &c., frequently used in agriculture as animal poison, plant fumigant, or weed-killer. Arsenic compounds are largely used as weed-killers. Lead compounds, as paint, are most deadly in the shape of old paint tins containing some of the moist paint, and also recently painted fences, gates, or even houses. Recent paint is especially attractive to cattle on account of the linseed oil with which the paints are mixed. Phosphorus is largely used for rabbit poison, and the cyanides for fumigating greenhouses, while strychnine is more and more used in certain seasons for killing rabbits. Caustic preparations are used in cleaning dairy apparatus; and it appears almost certain that the effluents running in open drains in dry weather may be consumed by stock, and if containing sodium hydrate or carbonate are injurious in proportion to the amount consumed. Excessive doses of salt such as may be found in kitchen refuse may be fatal to pigs and poultry if fed to those animals.

Indigenous Poisonous Plants.

The poisonous native plants of New Zealand, although comparatively few in number, are a most decided menace to stock-owners where there is any rough or virgin or partially broken-in land, or where the animals are driven through such areas. Poisoning by several New Zealand plants is more insidious, as some of them are, in limited amounts, beneficial in so much as they are undoubtedly highly relished and are good grazing material. It is only when the animals are driven or starved or are ravenous for a change of diet that they consume such large quantities that poisoning occurs. An endeavour is made below to place

* Portion of a paper read before the New Zealand Veterinary Association, Wellington, 26th July, 1933.

these New Zealand native plants in the relative order of their importance, an arrangement which, in the main, is considered justified : (1) *Coriaria* (3 or 4 species), tutu or tupakihi ; (2) *Pteridium aquilinum*, bracken or fern ; (3) *Myoporum laetum*, ngaio ; (4) *Pimelia* (several species), Strathmore weed ; (5) *Brachyglottis rangiora*, rangiora ; (6) *Urtica ferox*, onga onga or tree nettle ; (7) *Wintera (Drimys) axillaris*, horopito or pepper tree ; (8) *Hydrocotyle asiatica*, pennywort ; (9) *Edwardsia (Sophora) tetraptera* (several species), kowhai ; (10) *Ranunculus rivularis* (swamp buttercup), waoriki ; (11) *Dianella intermedia*, turutu ; (12) *Euphorbia glauca*, waiuatua ; (13) *Parsonsia* (2 species), kaiku ; (14) *Corynocarpus laevigata*, karaka.

The first four plants are undoubtedly responsible for stock poisoning from time to time, mainly the result of an abnormally low natural food-supply or a too restricted diet of an artificial kind. There is no doubt as to the poisonous nature of all four in New Zealand, and this is supported by what might be called their family history—that is, the known effects of closely allied plants in other countries. In the case of fern, stock are often crowded on to young grass country where the young fern is coming through in order to stamp and eat it out and no doubt experience poisonous effects in addition to starvation.

The tutu (*Coriaria* sp.) is the most historic poisoning plant of New Zealand, as Captain Cook lost the first animals he introduced by " toot " poisoning, as it is called by the settler. Dr. Lauder Lindsay states that in the early days those colonists were fortunate who had not lost 25 per cent. of their stock through tutu poisoning at the time of his visit (1861). Like another poisonous plant, ragwort, tutu in one of its forms is greatly relished by sheep, at times forming no inconsiderable part of their diet on rough hilly country. Cattle may also eat it in moderation, but when driven or when hungering for a change of diet, such as after being on a turnip paddock, they quickly succumb to large quantities of tutu ingested. This appears to be the case with all kinds of herbivores which will eat it, but it must be noted that no case in horses has ever been reported, and presumably it is distasteful to that animal.

There is a considerable literature on *Coriaria* or tutu, and the scientific results of the study of the active principle tutin (C_{17} H_{20} O_7), which was first isolated in this Department's chemical laboratory in 1900. There is still a large field for investigation in regard to the anomalous action of tutu plant on stock in the field and why at times it may be consumed as a regular part of the diet and at other times may act as a powerful and immediate poison : possibly there may be a very simple explanation for this. It has been proved thoroughly that the active principle tutin is destroyed very quickly by alkalies. The rumen contents are, of course, alkaline, so that if one could ensure that the whole of the ingested tutu entered the rumen one might predict beneficial instead of poisonous results from this palatable food. Cattle, in crunching up the long juicy shoots of the tutu produced in early summer, must surely squeeze out a large amount of liquid, which goes direct into the acid compartments of their digestive system without passing into the rumen. Therefore the tutin in this juice would have less chance of being destroyed by the alkaline secretion of the rumen. Perhaps this is the reason why cattle are more susceptible than sheep, which ingest into the rumen a drier form of the plant—namely, the leaves—

as they have less opportunity than cattle have for obtaining the giant shoots. Those who desire to follow the history of tutu poisoning in New Zealand cannot do better than consult the bibliography given on p. 143 of the Annual Report of this Department for 1900, and Dr. Fitchett's paper on the Physiological Action of Tutin, Trans. N.Z. Inst., Vol. 41, 1908, p. 365.

The next most common source of poisoning from plants is that occasioned by the New Zealand bracken fern (*Pteridium aquilinum*), variety *esculenta*, the roots of which were the staple farinaceous food of the primitive Maori. The above-ground parts are undoubtedly poisonous, and one American investigator of the bracken there showed that a drug habit was acquired by horses eating the fern, so that when stall-fed they ate their own bedding of bracken in preference to good hay. Exact feeding experiments have also been carried out in Great Britain and the poisonous nature of the English bracken fully demonstrated (see this Department's *Journal* for April, 1923).

Myoporum laetum (the ngaio), the well-known coastal tree, undoubtedly causes a large number of deaths in cattle every year, especially in the stormy winter season, when large limbs or trees are blown down into the paddocks and enable leaves, fruit, and branchlets to be reached by the cattle, which, possibly owing to shortness of feed at that time, greedily devour sufficient of the plant to cause poisonous symptoms. This is the time of the year when the fruit is ripe. In Australia an allied species (*M. deserti*) has poisoned sheep, according to Maiden, but only when the shrub is in fruit. He gives one instance of 500 out of a mob of 7,000 sheep dying from eating this poisonous plant ("Plants reputed poisonous to Stock in Australia," *Agricultural Gazette*, New South Wales, Vol. 8, 1897, p. 17). It is therefore quite probable that the New Zealand ngaio may be similarly fatal to sheep if they are compelled to eat it, although no instance of it affecting sheep has come under notice. Ewart ("Poison Plants and Naturalized Aliens of Victoria," 1909, p. 50) remarks that *M. deserti* is supposed to be poisonous when in fruit. This Department's *Journal* for August, 1926, contains an account by Webster of the poisoning of steers in Taranaki by eating ngaio. A Waikanae farmer lost five young heifers from ngaio poisoning in July, 1927. The ingesta consisted chiefly of ngaio leaves from an uprooted tree. Recently this species has been suspected of poisoning horses at Waverley. The most outstanding fact of all the cases in cattle is that the season was late autumn or winter, May to August. Some New Zealand veterinarians (this *Journal*, August, 1926) consider that the fruit of the ngaio is the poisonous part. Be this as it may, the oil of the leaves appears to be non-poisonous to guinea-pigs (see this Department's Annual Report, 1900, p. 127).

There are several species of *Pimelia* in New Zealand. Cheeseman in the "Manual of New Zealand Flora" records as many as fifteen species, but there may be several more, as the genus has not been critically studied. It is known in New Zealand generally as Strathmore weed, from the name of a Taranaki town where poisoning of horses was first recorded (see this Department's leaflet to farmers on the plant). The genus is confined to Australia and New Zealand. In Queensland several species are suspected of poisoning sheep. The genus *Pimelia* is closely allied to *Daphne*, a species of which are so much grown in gardens for the ornamental scented flowers produced. Daphne supplied a vesicant

to medicine under the name mezereon bark, and the Pimelias have a similar action in causing blisters and burning sensation in the mouth when chewed. This sensation persists for some time, and is a common symptom resulting from every species the writer has tasted. New Zealand cases of poisoning recorded relate largely to horses. A dry resinous mass which was extracted by volatile solvents from *Pimelia* bark by the writer was poisonous to guinea-pigs (see leaflet to farmers, No. 55, 1900). Some cases are recorded by Webster in the August, 1926, *Journal* of this Department, p. 102, in the Wairarapa. A case of mortality in calves which occurred at Te Kuiti in October, 1928, was probably due to leaving travelling stock (calves) in a starving condition in a paddock in which there was little else but *Pimelia*. This case was reported by the Stock Inspector of that district.

In any case where veterinarians find as a symptom blisters in the mouths of stock they would do well to seek the evidence of the ingestion of one of the species of *Pimelia*, all of which are found on stony or sandy waste land and often by roadsides where driven hungry stock are allowed to pasture.

Seddon and others (Veterinary Research Report, No. 6, Department of Agriculture, New South Wales, 1931, p. 122) give details of the poisoning of travelling sheep by eating *Pimelia pauciflora*, an Australian species. Feeding experiments by his Department confirmed the poisonous nature of the plant, but apparently animals would only eat it when starved. The prominent symptom recorded was acute gastro-enteritis. The *Pimelia* is one of the few plants that cause coarse anatomical changes when ingested by animals.

The rangiora (*Brachyglottis rangiora*) belongs to the largest botanical family of flowering plants, the *Compositae*, which contains all those plants producing "daisy" flowers. Although a common plant, the rangiora is but rarely suspected of poisoning stock. Baber (1886) states that this shrub is seldom eaten by cattle or sheep, but that horses are very fond of it. The effect on animals is said to be a staggering of the legs and falling. Skey (1881) failed to recognize any poisonous principle from *Brachyglottis*. The poisonous nature of some wild honey has been attributed to nectar from rangiora. The drunken condition of horses after eating rangiora leaves is stated by farmers to be curable by briskly exercising them. Elsdon Best (personal communication, 1900) reported that horses are supposed to be "wharangied" when poisoned by the rangiora, "wharangi" being another Native name for the shrub. Blood-letting and violent exercise are the Native cures. His own horse had been "wharangied," and had to be taken for a three-mile sharp canter to cure it. The stimulating nature of the rangiora poison is interesting in view of the fact that the imported ragwort belongs to the same family, and is highly poisonous to cattle and horses but less so to sheep, for which it is, in moderation, a useful fodder. In connection with the prominent symptom in horses—staggering—it is of interest to note that one of the English trivial names is "staggerwort." Apparently, from the observation of farmers who have communicated with the writer, cattle and sheep are seldom poisoned by rangiora, although they are known to eat large quantities of the leaves.

Urtica ferox (onga onga or tree nettle).—H. Guthrie Smith in "Tutira," 1921, p. 109, mentions that this unpleasant-looking plant

had caused the deaths of a horse and dogs. "My rabbiter lost one dog and had others crippled for days by this terrible nettle; a shepherd unwisely attempted to rush his well-bred horse through a mass of it, the animal became unmanageable, rolled, and refused to rise. Next day it was found dead." Mr. E. Liffiton, Wanganui, reported that a sporting dog stuck his nose into a bush, and apparently lost his scent for a week. Another struck himself between the hind legs, and was nearly dead for about a week. A horse blundering over a bush died in convulsions in three hours (Annual Report, New Zealand Department of Agriculture, 1909, p. 180). Recently, in the hills east of Lake Wairarapa, *Urtica ferox* has been suspected of injuriously affecting sporting dogs. According to Long ("Plants poisonous to Live-stock," 1924, Cambridge Press) the European giant nettle (*Urtica dioica*) is stated to have caused the deaths of dogs in Germany.

The horopito (*Drimys (Wintera) colorata*) is recorded as having poisoned cows at Okoroire in May, 1910, a large amount of the leaves being found in the ingesta. The leaves of both the New Zealand species are hot to the taste and are not likely to be eaten by stock unless they are driven by starvation to do so. The well-known Winter's bark comes from a South American species. The pennyworts (*Hydrocotyle*) belong to a world-wide genus. There are a number of species in New Zealand, but the only one concerning which there is any suspicion as being poisonous to stock is *H. asiatica*, now known as *Centella*, a cosmopolitan weed. This plant is said by Grandpré (1888, Nouv. Rem., April 8) to be an energetic stimulant, and in large doses a narcotic producing stupor, headache, and in some persons vertigo with a tendency to coma. A European species, *H. vulgaris*, is stated to have caused inflammation of the digestive tract and hæmaturia and to contain a toxic substance "vellarin." *H. asiatica* is a common weed often existing as a dense sward under manuka scrub in many parts of the North Island, and sheep may be driven by hunger to eat it. On the east coast of the Wellington Province a case of poisoning in sheep which has been supposed to have been caused by this weed has been reported at Akitio by Mr. R. H. Meade, Government Veterinarian. The symptoms he noticed were vertigo, stupor, and falling down and struggling at times, the animals remaining in this state for about a fortnight before death. On post-mortem the livers were found creamy-looking and atrophied, and the kidneys diseased, but the carcass fat and well nourished. It is interesting to recall that two of the trivial English names of the marsh pennywort (*H. vulgaris*) are "sheep-rot" and "white-rot."

A small native buttercup, *Ranunculus rivularis*, occurring plentifully in the swampy ground is known by the Maori name waoriki, and sheep are often found poisoned when grazing in swamps, and the cause is put down to waoriki. It is, however, difficult to identify any particular species from the swamp as having caused the mortality. Other swamp plants which have come under suspicion are the native *Pratia* and the allied *Lobelia*. Sheep fed on *Pratia* fruit at the Rangipo Prison camp failed, however, to show any poisonous symptoms. Another swamp plant, *Gratiola*, may be held under suspicion on the authority of Maiden, who also quotes cases of horses being poisoned by *Pratia erecta*, and cows by *Lobelia pratioides*, and sheep by *Isotoma* in Australia. A student, therefore, who wishes to investigate mortality arising from

swamp feeding of domestic stock has a range of possible species to investigate. Instances of the poisoning of cattle by waoriki are given in the 1905 Annual Report of this Department, p. 79.

In addition to the plants named in the above paragraph, there are a number of New Zealand species which must be held suspicious on account of their family history and known toxic effects of closely allied species in other countries. The fact that little is known of them as poisonous plants may be due to their unpalatable nature and to abundance of other food. The kowhais (*Sophora* or *Edwardsia*), of which there are several species, are probably all poisonous, but stock are not known to eat them.

Dianella (turutu), a small grass-like herb, is known to poison children who have eaten its attractive-looking blue fruits. *Euphorbia glauca* (waiuatua) is not likely to be eaten owing to its extremely unpalatable nature. It belongs to a very poisonous family. *Parsonsia* (kaiku) is a twining shrub belonging to a very poisonous family, *Apocynaceae* ; but no evidence is available that it is ever eaten.

The karaka (*Corynocarpus laevigata*) is a well-known tree throughout the northern part of New Zealand, extending as far south as Banks Peninsula. The large evergreen glossy leaves are a valuable forage for cattle in times of scarcity, the boughs being then cut down by the settler to enable stock to graze the leaves. The kernels of the fruit are certainly poisonous to man and some domestic animals. The evidence as to the poisonous action of the fruit on cattle is conflicting, and certainly warrants further investigation. Pigs are possibly only slightly affected, but dogs are easily poisoned if given the entire kernels. The explanation of the apparently anomalous action on different forms of animal life is that the active principle of the " nut " consists of a cyanogenetic crystalline body which requires appropriate conditions before the poisonous prussic acid can be evolved. The conditions may exist in certain animals and not in others. Thus the human and the dog are highly susceptible, but the pig and the ox are comparatively immune, from the effects of eating the fruit. The active principle " karakin " apparently requires that the enzymes present in the fruit shall be in contact with the principle before it can exert a poisonous effect, in this respect resembling the glucoside amygdalin, the principle of the bitter almond. Hence the pure principle " karakin " is only slightly toxic if at all, but the nut itself is deadly. What is of great interest is that the primitive Maori, who suffered from a deficiency of farinaceous foods, had here a supply of starchy fruit which would help to alleviate this deficiency, but was in the raw state inedible, bitter, and poisonous. By boiling or baking, the nuts became edible, palatable, and nutritious. One of the first things investigators ascertained in their endeavours to isolate the poisonous principle was that heating the extracts or original substance above the boiling-point of water destroyed the poison, thus confirming the wisdom of the Maori method for rendering the abundant supplies of nuts available for food.

(To be continued.)

The third conference of the New Zealand Grassland Association will be held at Palmerston North from the 2nd to the 5th October next. It will be opened by the patron of the association, His Excellency the Governor-General, whose deep interest in and wide knowledge of grass-farming activities are well known. The association cordially invites the attendance of farmers, merchants, and all others interested in grassland.

BARLEY FOR POULTRY FEEDING.

A COMPARISON WITH WHEAT.

H. A. KITTO, Overseer, Poultry Station, Wallaceville.

AN experiment was conducted at Wallaceville last year for the purpose of endeavouring to gain some first-hand information regarding the value of barley as compared with wheat when fed to laying birds. The results of this experiment were published in the August, 1933, issue of the *Journal of Agriculture*.

As it was fully realized that definite conclusions could not be drawn from the results of a single test of this nature, it was decided to repeat the experiment during the past year. In this test one hundred White Leghorn pullets were used. These were of similar age, bred from the same parent stock, and were selected as evenly as possible in regard to size, type, and points indicating laying-capacity and constitutional vigour.

Prior to the commencement of the test the hundred pullets were placed in one of two adjoining houses of the same size and design, and the birds were allowed to occupy the one house for several days, during which time they all received a similar ration—viz., whole wheat and barley. The day before the test commenced, fifty birds were drafted from the flock to the adjoining house without being handled, so that each lot of fifty birds was in possession of the quarters they were to occupy during the test.

The test extended over a period of forty-six weeks—viz., from 15th April, 1933, to 3rd March, 1934.

Sufficient food was weighed out at each weighing to last the birds for approximately ten days. The ingredients of the ration were kept in separate tin containers and apportioned out daily according to the birds' appreciation thereof. Any food left in the containers at the end of the test was weighed back and credited to the respective pens, so that the figures set out in Table 1 show the actual quantity of food consumed by each lot of birds during the test. For reference purposes the birds fed barley will be designated as Lot 1, and the birds fed wheat as Lot 2.

The rations of each lot were made up as follows:—

Lot 1.				Lot 2.			
Mash Mixture.		Grain.		Mash Mixture.		Grain.	
	lb.		lb.		lb.		lb.
Barley-meal ..	32	Barley ..	100	Wheatmeal ..	32	Wheat ..	100
Pollard ..	14	..		Pollard ..	14	..	
Bran ..	18	..		Bran ..	18	..	
Meatmeal ..	7	..		Meatmeal ..	7	..	
(approx. 10 per cent.)				(approx. 10 per cent.)			
Totals ..	71	.. ..	100	.. ..	71	.. ..	100

Table 1 shows the cost and amount of each of the food ingredients consumed by each lot of birds during the forty-six weeks of the test :—

Table 1.

Foodstuffs.	Average Prices.	Amounts consumed.	Cost of Foods used.
Lot 1 : Barley-fed Birds.			
	£ s. d.		£ s. d.
Barley-meal	7 17 0 per ton ..	743 lb. ..	2 18 4
Pollard	6 5 6 per ton ..	325 lb. ..	1 0 4¾
Bran	5 17 4 per ton ..	418 lb. ..	1 4 6¼
Meatmeal	8 6 1 per ton ..	325 lb. ..	1 4 1
Barley	0 3 5·35 per bushel	49·36 bushels	8 10 1
Total cost ..	..	..	14 17 5
Lot 2 : Wheat-fed Birds.			
Wheatmeal	8 0 0 per ton ..	720 lb. ..	2 17 7¼
Pollard	6 5 6 per ton ..	315 lb. ..	0 19 9
Bran	5 17 4 per ton ..	405 lb. ..	1 3 9
Meatmeal	8 6 1 per ton ..	282 lb. ..	1 0 11
Wheat	0 4 5·25 per bushel	41·6 bushels	9 4 7¼
Total cost ..	..	..	15 6 7½

Table 2 shows details of the number of eggs laid each month (in dozens), the average monthly prices received per dozen for the eggs, and the total net proceeds received each month during the period of the experiment.

Table 2.

Monthly Egg-yield, in Dozens.	Average Price per Dozen.	Proceeds received Monthly.
Lot 1 : Barley-fed Birds.		
1933.	s. d.	£ s. d.
April	21 8/12	1 11·11	2 1 8¾
May	25 5/12	1 10·70	2 8 1
June	31 3/12	1 7·59	2 11 0
July	50 5/12	1 5·68	3 14 3½
August	75 1/12	0 11·99	3 15 0¼
September	89 6/12	0 10·06	3 15 0½
October	89 7/12	0 10·71	4 0 0½
November	81 10/12	0 10·70	3 12 11½
December	80	0 11·75	3 18 4
1934.			
January	75	1 0·94	4 0 10½
February	63 3/12	1 2·04	3 14 0
March	51 1/12	1 2·30	0 7 0½
Total amount received for eggs	..	37 18 5
Total cost of foodstuffs used ..	..	14 17 5
Total profit over cost of production	..	23 1 0

Table 2—continued.

Monthly Egg-yield, in Dozens.	Average Price per Dozen.	Proceeds received Monthly.
Lot 2: Wheat-fed Birds.		
1933.	s. d.	£ s. d.
April .. .. .. $22\frac{9}{12}$	1 11·11	2 3 $9\frac{3}{4}$
May .. .. .. $30\frac{11}{12}$	1 10·70	2 18 $5\frac{3}{4}$
June .. .. .. $31\frac{4}{12}$	1 7·59	2 11 $1\frac{3}{4}$
July .. .. .. $53\frac{8}{12}$	1 5·68	3 19 $0\frac{3}{4}$
August .. .. .. $67\frac{11}{12}$	0 11·99	3 7 $10\frac{1}{2}$
September .. .. $80\frac{4}{12}$	0 10·06	3 7 4
October .. .. .. $88\frac{2}{12}$	0 10·71	3 18 $8\frac{1}{2}$
November 83	0 10·70	3 14 0
December 77	0 11·75	3 15 $4\frac{3}{4}$
1934.		
January .. .. .. $72\frac{7}{12}$	1 0·94	3 18 $3\frac{1}{4}$
February .. .. $58\frac{5}{12}$	1 2·04	3 8 $4\frac{1}{4}$
March .. .. .. $5\frac{1}{12}$	1 2·30	0 6 $11\frac{1}{2}$
Total amount received for eggs	..	37 9 $4\frac{1}{2}$
Total cost of foodstuffs used ..	..	15 6 $7\frac{1}{2}$
Total profit over cost of production	..	22 2 9

Table 3 gives a summarized statement of the experiment, covering the forty-six weeks' period.

Table 3.

Total Eggs laid and sold (in Dozens).	Amount received for Eggs.	Total Cost of Food.	Total Profit.	Cost of Food per Bird.	Cost of Feed to produce a Dozen Eggs.	Gross Profit per Bird.	Average Number of Eggs laid per Bird for Test.
Lot 1: Barley-fed Birds.							
	£ s. d.	£ s. d.	£ s. d.	s. d.	d.	s. d.	
689 ..	37 18 5	14 17 5	23 1 0	5 $11\frac{1}{2}$	$5\frac{1}{4}$	9 $2\frac{1}{2}$	165·36
Lot 2: Wheat-fed Birds.							
$671\frac{11}{12}$ ..	37 9 $4\frac{1}{2}$	15 6 $7\frac{1}{2}$	22 2 9	6 $1\frac{1}{2}$	$5\frac{1}{2}$	8 $10\frac{1}{4}$	161·26

Notes on the Experiment.

During the test both lots of birds ate their food well, and generally presented a healthy appearance throughout. At no time did Lot 1 show the slightest disinclination to eat the barley provided.

Unfortunately, a number of birds in each pen went into a moult shortly after being penned. The change of quarters and the unfavourable weather conditions experienced soon after the commencement of the test were no doubt responsible for the occurrence of this undesirable moult.

As was the case in the first experiment, it was noticed, when this one had extended over a period of about six months, that

Lot 1 presented a sleek, tight-feathered appearance, which was maintained until well after the termination of the test and right up until moulting-time.

Lot 2 showed more or less loose feathering as compared with Lot 1, and a more bulky appearance, but the contrast between the two lots of birds in this respect was not nearly so marked as in the former test. The fact that the whole of the birds taking part in this experiment had barley included in their ration after they had attained an age of about eight weeks was probably responsible for all the birds maintaining a more even appearance than was the case in the former test, as in this one no barley was provided to any of the birds during their growing-stage.

From observations made during both tests it appears safe to assume that the feeding of barley has a decided influence in encouraging the desired tightness of feathering in a laying bird.

Both lots of birds received two meals of mash daily—one in the early morning and one at midday.

The grain ration was fed in the evening, and, in order to induce the birds to exercise, this was well scattered in deep litter and in such a way that the birds were compelled to scratch and work to find the hidden grains. All birds were provided with as much food as they could eat at each meal without waste.

Broken oyster-shell and stone grit was always available for the birds to pick at.

Green food, consisting chiefly of succulent silver beet and young green oats, was fed daily and in abundance between 8 and 9 a.m. In addition to the meatmeal used in the mash, this material was supplied in hoppers placed in each house, and was available at all times for the birds to eat if so desired. The barley used in both experiments was Chevalier of high-grade quality, and was imported from Australia. The relatively low cost at which barley of this class could be purchased early in the year 1932 as compared with what is commonly known as fowl-wheat was chiefly responsible for the first experiment referred to being conducted as a means of ascertaining the respective values of the two kinds of grain when fed to laying birds.

Meatmeal, in addition to that used in the mash, was placed in a hopper in each house, and left before the fowls at all times. Lot 1 consumed from the hopper during the test a total of 159 lb. of meatmeal, 89 lb. of which was eaten between 1st August and 30th November. Lot 2 consumed from the hopper during the test 123 lb. of meatmeal, 68 lb. of which was consumed between 1st August and 30th November. It is of interest that both lots of birds consumed a greater amount of meatmeal during the four main laying months of the year than they did during any other period of the test.

A comparison of the egg-yields from both lots shows that Lot 1 produced 8,268, or 689 dozen, as against 8,063, or 671$\frac{11}{12}$ dozen laid by Lot 2, being a difference of 205 eggs, or 17$\frac{1}{12}$ dozen, in favour of the barley-fed birds. The respective averages per bird in each pen are: Lot 1, 165·36 eggs; Lot 2, 161·26 eggs.

It will be seen from Table 3 that the cost of producing each dozen eggs was 5$\frac{1}{4}$d. in Lot 1 and 5$\frac{1}{2}$d. in Lot 2, while the cost

of the foodstuffs consumed by each bird was 5s. 11½d. in Lot 1, against 6s. 1½d. in Lot 2, over the whole forty-six weeks' test.

The respective profits per bird over the period are seen to be 9s. 2½d. for Lot 1, against 8s. 10¼d. for Lot 2, a difference of 4¼d. per bird in favour of those barley-fed.

The difference of 9s. 2½d. between the total costs of foodstuffs consumed by each lot of birds is again in favour of the barley pen, but this is only a comparatively small margin—not nearly so great as last year. This is accounted for mainly by the fact that 6s. per bushel was the cost of wheat last year, while for the experiment this year the cost of wheat was 4s. 5¼d. Barley was a little cheaper for the second experiment than it was for the first, but not in the same proportion as the wheat.

The total net proceeds received for eggs from the barley pen is slightly higher than from the wheat pen, being 9s. 0½d. in favour of barley.

Reading the cost of foods together with the proceeds received, a difference of 18s. 3d. in the total net profits is revealed in favour of the barley over the whole period of forty-six weeks.

As in the experiment last year, the cost of oyster-shell and stone grit has not been debited in the returns. This, however, would not amount to more than 12s. to 14s. for each lot of birds.

AGRICULTURAL LIME CARRIED BY RAIL, 1933-34.

THE figures relative to lime carried by rail during the year ended 31st March, 1934, show an increase for the whole Dominion of approximately 10 per cent., compared with similar figures for 1932–33. The increases for the North and the South Islands being approximately 5 per cent. and 15 per cent. respectively. The Dominion total represents an increase of nearly 20,000 tons, and is the highest yearly tonnage of which we have records.

Up to 1930–31 the total for the South Island was invariably higher than that for the North Island, but since then the North Island totals have invariably been higher. Of interest also is the progressive increase of North Island figures from 23,000 to 100,000 tons in ten years.

Details, in tons, of quantities carried annually since 1st April, 1924, are as follow :—

Season.	North Island.	South Island.	Total for Dominion.
1924–25	23,265	68,241	91,506
1925–26	26,303	76,596	102,899
1926–27	29,474	71,230	100,704
1927–28	29,189	83,473	112,662
1928–29	42,258	99,858	142,116
1929–30	60,476	111,063	171,539
1930–31	72,678	83,168	155,846
1931–32	70,570	69,766	140,336
1932–33	94,701	79,413	174,114
1933–34	99,919	94,068	193,987

LEONARD COCKAYNE.

By the death at Wellington on the 8th July last of Dr. Leonard Cockayne, C.M.G., F.R.S., Hon. D.Sc. (N.Z.), Ph.D., F.L.S., F.N.Z.I., New Zealand has lost a savant whose eminence was a cause of profound national pride and whose work was of incalculable national value. In his chosen sphere, botany, his international ranking paralleled that of such other eminent workers as Lord Rutherford and Sir John Salmond in their spheres of physical science and of jurisprudence respectively. Dr. Cockayne's exalted status in the scientific world was due essentially to the fact that in ecology, the newest and, economically, the most valuable branch of botany, he was recognized by his co-workers as not merely a world pioneer, but a world leader. Ecology has been described briefly by Dr. Cockayne himself as "The class of research which deals with living plants and their relation to their surroundings, and which gathers its data from actual observations in the field."

Therefore it is fitted to provide "a more accurate knowledge regarding the maximum and minimum requirements of each economic plant and its behaviour when growing in company with other plants and animals." From this it follows not merely that ecology, if properly applied, would increase efficiency in agriculture, but also that all successful farmers actually are practical ecologists. The value of ecology lies in the fact that it tends to convert empirical or rule-of-thumb knowledge into knowledge based upon understanding and correlated with established principles. The relation between empiricism and ecological method has been clearly exemplified by Dr. Cockayne in the following words:—

"A certain method of treatment for a certain sand area may prove efficacious by the method of 'Try this, or that, and something good may turn up.' But let the result of this system be applied to another dune area where the supply of sand is rather greater, the climate rather drier, and the average angle at which the sea-wind strikes the dunes rather less oblique; the method so successful elsewhere fails at once. But attack the dune problem ecologically; study accurately the tactics of sand when exposed to wind; study also its physical properties, the relation of the natural plant-covering of various types of dunes to moving sand, the climate of the area, the evolution of the vegetation from that of the unstable sandhills to those quite fixed by vegetation, and so on; find out exactly how Nature works under the many conditions that dunes offer; note exactly the plant-forms which can survive different degrees of sand-advance; then, when these preliminaries are fully mastered, with some degree of confidence the investigator can attempt the 'reclamation' of a dune area, and, adding to his ecological knowledge by further observations and experiment, is finally in a position to draw up for agriculture those rules for dune culture which alone can fully succeed."

From this illustration one can readily conceive ecological methods being applied to some of the major problems of both the principal and the subsidiary rural industries, and it becomes apparent that under suitable direction the findings of ecology are fitted to advance agriculture in its many phases. The influence of Dr. Cockayne's work

THE LATE DR. LEONARD COCKAYNE, C.M.G., F.R.S., HON. D.SC. (N.Z.), PH.D., ETC.

provides much further evidence of this: it has supplied many of the fundamental conceptions underlying the work of officers of the Department of Agriculture, of the Plant Research Station, of the Forestry Department, and of other institutions similarly concerned with the scientific study of primary industries.

In addition to pioneering fundamental conceptions upon which much doctrine and investigation depends, and will depend in the future, Dr. Cockayne made to our knowledge direct additions of great economic value. Outstanding among these in the agricultural sphere is the monumental work relative to the montane tussock grassland of New Zealand—an area of some 6,000,000 acres which is the main grazing-ground of the nationally valuable mountain flocks of the South Island. In this work his remarkable array of talents, which led to his eminence in science, was necessarily exercised and strikingly illustrated, for the work called for an association not only of such mental attributes as scientific outlook, business acumen, and constructive imagination, but also of unlimited physical energy, and all these in a man of well over sixty years of age.

That Dr. Cockayne's montane tussock grassland work promises to be a botanical classic is to some extent indicated by the fact that as lately as December last it was cited in the recently founded *Empire Journal of Experimental Agriculture*.

During his widespread field studies of New Zealand vegetation Dr. Cockayne established the fact that wild hybrids are prevalent in many genera. The significance of this for forestry he realized, and indicated in his monograph of the beeches; for agriculture it has an important bearing on the work being developed in endeavours to secure improved strains of grasses.

Further work of Dr. Cockayne that was of direct and great economic value to our primary industries related to the flax *(Phormium)* industry, to the management of New Zealand's comparatively extensive sand areas, and to her valuable forests.

During his lifetime merited scientific honours were freely bestowed upon Dr. Cockayne, but the crowning honour was the award by the Royal Society of England of the great Charles Darwin medal, relative to which the famous New-Zealander Lord Rutherford indicated a similarity in merit between Dr. Cockayne's outstanding work and that of Darwin himself.

It is natural in this *Journal* for emphasis to be placed on the value of Dr. Cockayne's work to the rural industries, but in point of fact his genius and erudition reached so widely that the sphere of his influence has been truly national. In the realm of pure science and in that of horticulture, by personal inspiration as well as by writings, always clear and forceful and often delightful, he has made a profound and lasting impression on national culture. Happily public appreciation of this was expressed during his lifetime not only in the scientific honours, but also in the civic honours, which rightly were given him.

At Mangawhata, Manawatu, eighteen months ago, Marlborough lucerne was sown side by side with imported seed to which it is superior markedly in growth and vigour.

PRODUCTION OF WILT-FREE BEANS.

W. D. Reid, Plant Research Station, Palmerston North.

In a previous paper on the bacterial wilt of beans* the morphology and identity of the causal organism and symptomatology and control measures of the disease were discussed. The paper indicated that, as this disease is seed-borne, two possible methods of control are available: (1) Seed-disinfection, and (2) use of disease-free seed. So far numerous trials by the Field Mycologist have failed to evolve a suitable seed-treatment. On the other hand, the production of disease-free seed has been secured by selection, and this supplies a practical method of obtaining disease-free crops. This paper records the methods adopted during the last three seasons. During the third week of October, 1931, trials were sown at the Plant Research Station area by the Agronomist to determine the numbers of commercial lines which had become infected during the initial outbreak of the previous season. Seventy-one lines of different varieties, together with six diseased controls, were sown. The majority of the plots consisted of five drills of eleven yards each, separated from the adjoining plots by three drills of barley. The remaining plots comprised three drills of 1 chain each separated from the next plot by two drills of potatoes. By this arrangement each plot was enclosed by a wind-break of barley or potatoes.

Bacterial wilt first appeared on the 3rd December as primary leaf lesions in four plots. Thereafter, more particularly during a warm moist period from the 3rd to the 10th December, many more plots produced initial outbreaks, from which infection of surrounding plants was rapid. Initial outbreaks were characterized by ooze on the stems of stunted plants, and secondary infections by typical lemon-yellow lesions on the young secondary leaves. Leaf lesions remained the chief symptoms of infection up to the 25th January, after which pod lesions appeared as the most obvious symptom of the presence of the disease. Owing to the rapid spread of the disease, the determinations of the presence or absence of primary leaf and stem lesions—as indicators of seed-infection—were not reliable, and consequently the trials did not give accurate experimental results. However, the following conclusions were derived from the season's observations: (*a*) The disease was, with the exception of one line of butter bean, confined to lines of seed of Canadian Wonder varieties.† (*b*) Canadian Wonder and butter bean varieties were readily infected from adjacent diseased plots. (*c*) Epicure, Zebra Runner, and Scarlet Runner varieties did not exhibit any symptoms of infection at any period during the season.‡

The regular examinations of the plots also provided data on the symptoms, the dissemination of the disease, and the effect of rogueing certain plots. These are briefly discussed, as they had a definite bearing on the elimination of the disease.

* Reid, W. D.: "A Bacterial Wilt Disease of Beans." *N.Z. Journal of Agriculture*, Vol. 43, pp. 408–415, 1931.

† The Canadian Wonder variety refers to typical Canadian Wonder beans and similar varieties as Green Pod, Long Pod, Kentucky Wonder, &c.

‡ In the previous paper the Scarlet Runner bean was proved susceptible to this disease.

Symptoms of the Disease.

As shown in the previous paper, the first symptoms consist of small $\frac{1}{8}$ in. angular dark-green lesions on both surfaces of the primary leaves. Infections generally occur in small patches of three to four plants, one or more of which always exhibit typical water-soaked stem lesions, usually with whitish ooze adjacent to the cotyledon leaves. These

FIG. 1. SEEDLING INFECTION, SHOWING GLOBULES OF OOZE INDICATED BY ARROWS.

plants usually wither, blacken, and die, but remain a source of infection for surrounding plants. The secondary and more noticeable symptoms are the "halo" spots on the secondary leaves. These lesions are more or less circular light-coloured areas $\frac{1}{4}$ in. to $\frac{1}{2}$ in. in diameter, with a small dark-green glistening central portion which is visible on both

leaf surfaces. After twelve to fourteen days and with the increasing vigour of the healthy plants infection takes the form of bright lemon-yellow leaf lesions, $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. in length, irregular in shape, and

FIG. 2. PRIMARY-LEAF LESIONS OF BEAN SEEDLING.

always containing the small angular dark-green shining portion about $\frac{1}{16}$ in. in diameter. The yellow leaf lesions are the predominating symptoms of infection for the greater part of the season.

Pod lésions were first observed in the second week of January as circular dark-green water-soaked areas, $\frac{1}{8}$ in. in diameter, usually with a central minute head of ooze. These lesions gradually extend in area, and, should they coalesce with adjacent lesions, often affect large portions of the pod. These lesions on green pods are normally covered by a slimy film of bacteria.

Dissemination.

To prevent possible dissemination by implements, all cultivation was discontinued after the first appearance of primary-leaf lesions. The disease appeared to spread rapidly, but an early study of each plot showed that the majority of affected plants were adjacent to points of primary infections and that at this stage the amount of disease was governed mainly by the number of seedling infections. The spread of the disease consisted of a slow progression from these centres of infection, generally along the drills. Where growth was luxuriant, and plants in adjoining drills were touching, the disease spread radially at more or less an even rate. One week to ten days (a time which coincides with the incubation period of the disease) appeared to be sufficient for the disease to spread from an infected plant over an orbicular area 2 ft. to 3 ft. in diameter.

Dissemination was governed by the distance between infected and non-infected plants or areas. It was found that a distance of 2 ft. 4 in., occupied by three drills of barley, was insufficient to prevent cross infection. A separation of 7 ft., occupied by two drills of potatoes, also permitted cross infection, but to a much less extent than the 2 ft. 4 in. break. A distance of 2 chains prevented cross infection. It is not suggested that under all conditions a separation of 2 chains is a safe barrier to transmission of the disease, but it does indicate that the range of spread is limited. The spread of the disease in the field is believed to be due chiefly to insects (aphides, leaf-hoppers, &c.), and in part to wind and implements, but has not been verified by experimental evidence.

In order to restrict the spread of the disease, removal of infected plants was adopted. At first only the plants with lesions were removed, but experience showed that for the eradication of all infected plants it was necessary to remove all plants within a radius of 2 ft. or 3 ft. of a plant with visible lesions. This procedure reduced the recurrence of disease in rogued plots, and a more thorough examination and rogueing was then adopted in an attempt to obtain disease-free crops. The success of rogueing also depended on the percentage of primary infections and on the closeness of the plants. In the above trials the seeding was approximately two bushels per acre, and in the majority of the diseased lines one to six points of primary infection were observed. In some heavily infected plots 10 per cent. of the seedlings was infected, and such lines were removed shortly after the appearance of secondary lesions. The elimination of the disease was most readily obtained in those plots sown as three drills of 1 chain length. The result of rogueing provided many lines free from disease, for, in addition to the removal of infection in diseased lines, this rogueing also prevented spread to clean crops.

In the following season fifteen of these lines were sown at the Plant Research Station farm, the Tangimoana Forest Reserve, and a section within the residential area of Palmerston North City.* In

* These plots were sown with disease-free seed from rogued and unrogued plots.

these trials the seed was sown every 4 in. to 6 in. in drills 12 in. to 14 in. apart. Experience showed that wider spacing of seed and drills would have been advisable. The Tangimoana Forest Reserve is a sand-dune area, and the isolation plots were several miles from the nearest cultivated land. At no time did bean-wilt appear in the four lines sown in this locality. At the Station farm two of the plots were

FIG. 3. TYPICAL LEMON-YELLOW LEAF LESION ON SECONDARY LEAF.

within 2 chains of an infected control crop, while at the city area the plots were approximately ten yards apart and the area was within a few chains of neighbouring vegetable-gardens. The disease occurred in five of the eleven plots in these areas. The symptoms appeared only as secondary-leaf lesions one month to two months later than in the infected control. Three of the infected crops were the progeny of

crops which had remained free of the disease during the previous season. Cultivation ceased as soon as bean-wilt appeared, and rogueing of the initial outbreaks prevented further spread within the plots and areas.

At the close of the season 24 lb. to 40 lb. of seed was harvested from each plot; ten of the plots had remained clean, and five were, after removal of the diseased plants, believed to be free from infection.

In the 1933–34 season further trials were carried out, but more care was exercised in obtaining isolated areas. Further areas were utilized at the Tangimoana Reserve, and all of these produced disease-free crops. Six other localities at a distance of not less than five hundred yards from market or homestead gardens were selected on private farms and farms established under the Small Farm plan. The seed used was harvested from some of the crops mentioned above, three of which had been infected and rogued in the 1932–33 season, one of which had been infected and rogued in the 1931–32 season but not infected in the following year, and two of which had remained clean during these two seasons. The areas varied from $\frac{1}{8}$ acre to 2 acres, and were sown, cultivated, and harvested by the farmer. This Station carried out periodical examinations for the presence of bean-wilt. The seed was sown in 14 in. to 48 in. drills, seed 4 in. to 6 in. apart. Bean-wilt was not observed in any of these crops. On account of the unfavourable weather conditions some of the crop yields were poor, and two crops failed to reach maturity, but the trials have demonstrated the practicability of producing disease-free seed.

SUMMARY.

Trials with diseased and disease-free lines of bean seed sown during the last three seasons are discussed. The typical symptoms of bacterial wilt of beans are given—*i.e.*, stem lesions, primary-leaf infections, secondary-leaf infections, and pod lesions.

The dissemination of the disease is limited, rarely spreading for distances greater than 2 chains. Rogueing of diseased plants has proved successful in eliminating the disease, and with adequate isolation disease-free seed has been produced under normal farming conditions.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR THE YEAR 1933–34.

LISTS of butter and cheese manufacturing companies (co-operative and proprietary) which have obtained for their export produce an average grade of 93 points and over for the past dairy year—1st August, 1933, to 31st July, 1934—are given below.

Butter-factories included in this list number 102, as compared with ninety for the previous year, eighty-three being situated in the North Island and nineteen in the South Island. No less than thirty of these averaged over 94 points, as compared with twenty-four for the previous year, the highest individual average being 94·875.

As indicative of the general improvement in cheese quality during the year, twenty-seven cheese-factories obtained a place in the list, as compared

with seven for the previous year. Of this number thirteen are located in the North Island and fourteen in the South Island.

Company or Proprietor.	Registered Number.	Brand.	Tonnage graded.	Average Grade.
Butter-factories.				
Rangiwahia-Ruahine ..	750	Quail	273	94·875
Levin	910	Lake	1,454	94·814
Rangitikei	1360	Rangitikei ..	833	94·785
Golden Bay	620	Sovereign	620	94·755
Taieri and Peninsula ..	54	Peninsula	62	94·740
Inter-Wanganui ..	6	Inter-Wanganui ..	199	94·652
Lepperton	49	Lepperton	141	94·613
Awahuri	664	Red Rose	1,066	94·562
Wangaehu	1326	Wangaehu ..	656	94·511
Midhirst	110	Rugby	1,373	94·506
Uruti	300	Uruti	268	94·429
Rongotea	8	Rongotea	862	94·418
United	1220	Whariti	204	94·403
Moa Farmers	341	Inglewood, Heath ..	1,349	94·385
Arahura	1516	Arahura	110	94·385
Rata	938	Rata	1,168	94·365
Shannon	1489	Shannon	1,202	94·357
Kaikoura	302	Kai	334	94·287
Mangorei	345	Mangorei	939	94·264
Okau	872	Okau	238	94·255
Tamaki	1463	Bell	357	94·165
Masterton	1307	Masterton ..	838	94·143
Tikorangi	102	Shield	469	94·133
Maketawa	342	M.D.C.	317	94·120
Kokotahi	1144	Kokotahi	128	94·116
West Coast Farmers ..	675	Silver Pine ..	77	94·109
Omata	82	Omata	521	94·099
Waitara	726	Waitara	551	94·098
Tarata	631	Tarata	143	94·047
Tarurutangi	728	Champion ..	132	94·009
North Taranaki ..	723	Flax	612	93·997
Taieri and Peninsula ..	1234	Peninsula, &c. ..	248	93·936
Wairoa	1345	Wairoa, &c. ..	650	93·932
Murchison	1888	Airship	155	93·844
Karamea	1570	Karamea	190	93·829
Bell Block	488	Bell Block ..	192	93·819
Ruawai	66	Ruawai	1,531	93·769
Kaitaia	1298	Kaitaia	1,602	93·759
Kaikohe	40	Kaikohe	267	93·734
Taihape	1188	Tikapu	582	93·722
Whakaronga	1709	Whakaronga ..	203	93·719
Mauriceville	14	Mauriceville ..	834	93·713
Kairanga	1768	Longburn ..	668	93·704
Stratford	68	Stratford	1,119	93·702
Okoia	413	Okoia	1,206	93·687
Farmers' Dairy Federation	336	Murihiku	486	93·683
Norsewood	600	Norsewood ..	946	93·671
New Zealand	291	Anchor, &c. ..	1,867	93·661
Collingwood	1254	Golden Hills ..	137	93·652
Tolaga Bay	1007	Tolaga Bay ..	268	93·647
New Zealand Farmers' Dairy Union	100	Hinemoa	1,067	93·579
Municipal Milk Depot ..	202	Rahui	133	93·579
Ngatiporou	395	Nati	653	93·577
Kuku	905	Ohau	140	93·576
Hauraki Plains ..	1900	Hauraki Plains ..	63	93·558
Apiti	414	Apiti	353	93·540
Eltham	31	Eltham	849	93·515

Company or Proprietor.	Registered Number.	Brand.	Tonnage graded.	Average Grade.
Butter-factories—*continued.*				
Te Aroha - Thames Valley	344	Overseas	1,953	93·515
Maungaturoto	1407	Otamatea	934	93·513
Kia Ora	926	Kia Ora	1,461	93·505
Northern Wairoa	1358	Northern Wairoa	2,427	93·496
Cheltenham	3	Pakeha	2,574	93·484
Alpine	792	Alpine	22	93·475
Taihape	1188	Tikapu	108	93·451
Farmers' Dairy Federation	165	Murihiku	260	93·429
Co-operative Dairy Co. of Otago	266	Huia	662	93·418
Konini	1203	Konini	542	93·384
Waitoitoi	20	Waitoitoi	73	93·383
Westland Cold Storage and Dairy Co.	145	Westland	98	93·376
Opotiki	337	Opotiki	1,853	93·374
Golden Coast	387	Golden Dawn	33	93·360
Whenuakura	1237	Whenuakura	188	93·339
Morrinsville	330	Lockerbie, &c.	3,000	93·337
Kaipara	794	Poplar	2,319	93·329
Piopio	603	Piopio	748	93·316
Bay of Islands	1312	Bay of Islands	1,072	93·311
Northern Wairoa	4	Northern Wairoa	727	93·310
Rodney	394	Rodney	597	93·303
Rangitaiki Plains	133	Rangitaiki Plains	3,592	93·303
Mokau	274	Mokau	204	93·269
Hikurangi	303	Hikurangi	1,738	93·256
Heretaunga	1230	Heretaunga, &c.	1,358	93·248
Waitaki	1013	Waitaki	248	93·245
Bay of Plenty	1399	Bay of Plenty	2,704	93·231
Matakana	1375	Matakana	296	93·207
Pahiatua	140	Pahiatua	230	93·180
New Zealand	1458	Anchor, &c.	1,096	93·179
New Zealand	111	Anchor, &c.	3,096	93·171
Tai Tapu	175	Tai Tapu, &c.	891	93·166
Featherston	360	Featherston	118	93·166
Manakau	815	Manakau	211	93·150
Invercargill Dairy Co.	290	Rakiura	19	93·143
Port Albert	298	Port Albert	587	93·127
Tariki	1818	Tariki	113	93·120
Whangarei	1720	Kauri	2,575	93·112
Raglan	1470	Raglan	579	93·101
Arawa	1887	Arawa	559	93·061
Maungatapere	1710	Moana	775	93·044
Golden Coast	991	Golden Coast	182	93·026
Caroline	236	Caroline	159	93·019
Aria	1734	A.D.C.	180	93·019
Eketahuna	46	Eketahuna	1	93·000
Cheese-factories.				
Omimi	74	Omimi	81	93·925
Westmere	1621	Westmere	399	93·797
Milton	1030	Milton	117	93·682
Little Akaloa	32	Little Akaloa	57	93·526
Lepperton	49	Lepperton	264	93·498
Marton	660	Marton	61	93·424
Oware	662	Oware	164	93·422
Stirling	292	Stirling	450	93·311
Kaponga	1694	Kaponga	796	93·292
North Taranaki	212	North Taranaki	453	93·267
Kaimata	992	The Oaks	408	93·254
Milford	267	Milford	173	93·239
Rapanui	1714	Southern Grove	121	93·222

Company or Proprietor.	Registered Number.	Brand.	Tonnage graded.	Average Grade.
Cheese-factories—*continued.*				
Lowgarth	629	Lowgarth	553	93·219
Kaitangata	1648	Kaitangata ..	127	93·192
Tisbury	701	Tisbury	169	93·181
Pahia	707	Pahia	161	93·170
Ngutuwera	753	Ngutuwera ..	158	93·132
Bell Block	71	Dove	191	93·117
Cardiff	10	C.C.C.	624	93·102
Opouriao	1169	Opouriao	358	93·095
Switzers	802	Switzers	67	93·061
Edendale	36	Pioneer	620	93·037
Tussock Creek	313	Tussock Creek ..	27	93·023
Woodlands	1485	Woodlands ..	405	93·021
Kahui	493	Kahui	121	93·012
Orari	254	Orari	206	93·000

REVIEW.

Toadstools and Mushrooms and other Larger Fungi of South Australia : Part I. By JOHN BURTON CLELAND, M.D. Royal octavo, 178 pp., 6 coloured plates, 35 text figures : Government Printer, Adelaide.

THIS publication, covering the gill fungi (*Agaricaceae*), is one of a series of handbooks (No. 15, in fact) covering the flora and fauna of South Australia issued by the South Australian branch of the British Science Guild. Twenty-nine pages are devoted to an interesting general introduction, covering different aspects of the fungi, such as their role in nature, food-value, ecology, methods of preserving and identifying specimens, &c. The principal part of the work is devoted to a detailed taxonomic account of the gill fungi present in South Australia. Each species is carefully described, the descriptions being drawn by the author from fresh specimens collected by himself, and accompanied by ecological details of distribution, habitat, and edibility. For many years Dr. Cleland has been preparing careful records of these interesting plants ; and, as evidence of the virgin nature of this field he has been exploring, it is shown that of the 287 species listed, grouped under 54 genera, no less than 179 are endemic, 160 being erected by the author, alone or in collaboration with Mr. E. Cheel. The classification followed is that of most recent specialists of the group. One valuable aspect of the work is the notes on the edibility of these Australian plants ; for Dr. Cleland has personally tested, not without risk of agaric poisoning, all species which occur in sufficient numbers to warrant them being employed as food.

The study of this group of fungi has always proved difficult, as it is possible to identify and describe plants only from freshly collected specimens, a disadvantage which precludes comparisons being made with overseas species by overseas specialists. Consequently this book is especially welcome, as hitherto no reliable publication has been available to Australian mycologists. Many of the endemic species have been illustrated (about twenty being in colour) from drawings prepared from fresh plants by well-known botanical artists.

Unfortunately the book was published during times of economic stress. In consequence it has been printed in 10-point type, bound in paper covers, and much interesting matter, many valuable illustrations, and an index have been omitted so that the price (5s.) should be sufficiently low to place the work within the reach of all students.

The editorial preface states that the volume is one of a series prepared gratuitously by South Australian biologists and geologists. Dr. Cleland has earned the gratitude of students of the gill fungi by the production of this labour of love, representing the results of many years of arduous work, now generously given to the public.

G. H. C.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING AUGUST, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list supplements that published in the July and August issues of the *Journal*, and refers to those crops passed during August. Further lists will be published in later issues.

In the June *Journal* was published a list of growers who have received provisional certificates. The acreage, percentages of foreign varieties present, and the group number and classification representing the relative merits of lines were given in that list, to which intending purchasers should refer.

AUCKLANDER SHORT TOP.

Mother Seed—
Adams Bros., Sheffield.
Barnett, A., Leeston.
Carroll, A. D., R.M.D., Southbridge.
Crump, F., R.M.D., Springston.
Government Pure Seed Station, Box 4, Lincoln.
Heron, F., R.M.D., Rangiora.
Jellie, J., Russley Road, Fendalton, Christchurch.
Marshall, D., R.M.D., Leeston.
Oliver, W. R., Hororata.
Poulton, A. D., R.M.D., West Eyreton.
Rathgen, A. E., R.M.D., Leeston.
Roper, R. S., R.M.D., Halkett.
Wolff, R. G., R.M.D. Horrelville.
Wright, L. T., Annat.

Commercial Seed—
Anderson's Estate, Ladbrooks.
Breitmeyer and McFarlane, Little River.
Ferguson, J. W., R.M.D., Winchmore.
Guy, T. A. and E. B., Yaldhurst.
Haines, C., 108 Waimakariri Road, Christchurch.
King, W. H., Rosewill R.D., Timaru.
Martin, A., Box 42, Morven.
Miller, G., Seadown, Timaru.
Watson, R. G. and L. J., Springbank R.M.D., Rangiora (Line A).
Watson, R. G. and L. J., Springbank R.M.D., Rangiora (Line B).
Wilson, M., R.M.D., Halkett.

DAKOTA.

Mother Seed—
Adams Bros., Sheffield.
Crozier, W. J., Mount Hutt R.M.D., Rakaia.
Gardiner, O. J., Dunsandel.
Government Pure Seed Station Box 4, Lincoln.
Marshall, D., R.M.D., Leeston.
Steele, J., R.M.D., Kimberley (Line A).
Wolff, R. G., R.M.D., Horrelville.

Commercial Seed—
Cross, H. E., R.M.D., Weedons.
Ellmers, J. W., Kaiapoi.
King, W. H., Rosewill R.D., Timaru.
Miller, G., Seadown, Timaru.
Oakley, J. T., R.M.D., Eiffelton (Line A).
Skurr, J. E., Sheffield.
Steele, J., R.M.D., Kimberley (Line B).

ARRAN CHIEF.

Mother Seed—
Griffin, J. G., Te Waewae, Southland.
Henderson Bros., Otapiri R.M.D., Southland (Line A).
Knowler, H., Te Waewae, Southland.
Knowler, H. C., Te Waewae, Southland.

ARRAN CHIEF—*continued.*

Commercial Seed—
Bell, J. F., Stirling (Line A).
Henderson Bros., Otapiri R.M.D., Southland (Line B).
Reid, W. P., Maheno, via Oamaru.
Saunders, E. E., Studholme Junction (Line B).

ARRAN BANNER.

Mother Seed—
Amyes, H. C., R.M.D., Annat.
Burgess, D., West Plains, Southland.
Henderson Bros., Otapiri R.M.D., Southland.
Milburn, M., R.M.D., Wright's Bush, Gladfield.
McAdam, H. M., R.M.D., Invercargill–Glenco.
Macalister, J. G., Otapiri R.M.D., Winton.

Commercial Seed—
Manson, D. J., Enfield, via Oamaru.
Penn, T. A., 154 Innes Road, Christchurch.
Porter, E., St. Andrew's.
Roper, P. F., R.M.D., Halkett.

AUCKLANDER TALL TOP.

Mother Seed—
Frost, C. H., P.O., Balcairn.

Commercial Seed—
Miller G., Seadown, Timaru.

KING EDWARD.

Mother Seed—
Anderson, A., Stirling (Line A).
Burgess, D., West Plains, Invercargill (Line A).
Cox, S., Box 9, Willowbridge.
Milburn, M., R.M.D., Wright's Bush, Gladfield.

Commercial Seed—
Anderson, A., Stirling (Line B).

[illegible]

Mother Seed—
Penn, T. A., 154 Innes Road, Christchurch.

EPICURE.

Mother Seed—
Robinson, R. G., Box 4, Papanui, Christchurch.
Shellock, W., Te Pirita R.M.D., Rakaia.
Wright, L. T., Annat (Line B).

IRON DUKE.

Commercial Seed—
Herridge, F. G., Woodend.
Penn, T. A., 154 Innes Road, Christchurch.

PREECE'S PROLIFIC.

Commercial Seed—
Allen, A., R.M.D., Leeston.

GREAT SCOT.

Commercial Seed—
Government Pure Seed Station, Box 4, Lincoln.

—*Fields Division.*

On heavy land of good fertility at Halswell mangels sown with 2 cwt. an acre of superphosphate resulted in an excellent crop, except for a portion which inadvertently was not manured, and which gave a very poor crop.

SEASONAL NOTES.

THE FARM.

A Neglected Phase of Grass Farming.

OFTEN in practice the utilization, as distinct from the production, of feed on grassland does not receive as much attention as its importance justifies. Production of feed is only one phase of farm-management, and, if production of feed is not linked suitably with utilization, it can be said with certainty that the fullest possible returns will not be obtained from such measures as top-dressing, harrowing, and subdivision. Indeed, it may be stated correctly that measures intrinsically judicious, such as top-dressing, may be made practically futile by inefficient utilization of the additional growth of grassland which results from the top-dressing. Typical of the instances which could be quoted in illustration of this is the case of sheep-farmers who have increased their top-dressing programmes without increasing their flocks commensurately with the increased feed available in late spring and early summer as a result of the increased top-dressing. Such farmers have bewailed the detrimental influence of top-dressing upon fat-lamb production, although they have often been faced with the fact, rather difficult to explain satisfactorily, that the same type of top-dressing has given distinctly profitable results on adjacent essentially similar farms. Usually such farmers should condemn not the direct influence of top-dressing, but their own imperfect utilization, in respect to which inefficiency has been intensified by the top-dressing. In some districts last year favourable weather conditions in the spring and early summer brought about the result that has been attributed at times to top-dressing: because of the excessive amount of feed on hand some farmers in such districts could not satisfactorily fatten their lambs The corresponding result in dairying is a premature unduly rapid decline in butterfat production; at times because of deterioration in the quality of feed, consequent on a surplus supply, the decline in butterfat production which commonly characterizes the latter part of January has been recorded in early December and even in late November. Both in sheep-farming and in dairying the undesirable results cited have occurred because the feed available has been unsuitable for milk-production—while more than ample in quantity, it has been deficient in quality.

A further important phase of the same matter is that the results of inefficient utilization of grassland are not confined to poor returns from the feed produced, but under certain circumstances may readily bring about deterioration of the sward and a consequent decline in its productive capacity This is because poor utilization of grassland normally consists of both under-grazing in the late spring and summer and overgrazing in the winter and early spring—a type of grazing management which tends to a weakening of the species which produce feed early in the season and a strengthening of those which make relatively late growth. In the mixed swards characteristic of very extensive grassland areas, it leads quickly to the suppression of perennial rye-grass and to the dominance of species akin to brown-top and sweet vernal. Stated briefly, the trend of modern thought relative to grassland is that generally soil and climatic conditions do not govern the botanical composition of a sward so completely as is often believed, and that frequently the stock-grazing conditions are the real directing factor This generalization is not valid in respect to extreme conditions of soil or climate, when the influence of grazing management may be offset or masked by the greater influence of other conditions. But it is so widely valid as to justify more attention by farmers to the utilization in contradistinction to the production of the growth of pastures.

Many seem not to realize that poor utilization of pastures leads frequently to stock being badly fed at two critical periods annually, whereas under a system of good utilization the same number of stock could be comparatively well fed with an equal amount of feed; under poor utilization the feed is likely to be ample in quantity but lacking in quality in early summer, and lacking in quantity in winter and early spring. This is primarily because frequently 70 per cent. or more of the feed directly available from grassland is produced during the spring and early summer.

In the absence of good utilization the general result is the adoption, in respect to stocking, of a half-way course which brings about an unsatisfactory feed position both in the period of high production and in that of low production—understocking in the former period, overstocking in the latter.

To sum up, poor utilization not only has an undesirable influence upon the swards, but also leads readily to much poor feeding that could be avoided largely without any increase in the amount of feed produced. The essential facts as stated above seem so obvious and simple as to be scarcely worth mentioning until it is remembered that these facts, important though they be, often are not reflected in our farm practice. Fortunately, even in times economically difficult when occasionally it is necessary to abstain from outlay that is well justified there is no real reason why a general improvement in the standard of pasture-utilization cannot be effected—often greatly improved utilization may be brought about without either the introduction of difficult practices or the expenditure of much money. Unsatisfactory utilization arises largely from allowing pasture growth to become too rank, mature, and stemmy during spring and summer, and also from continuously grazing closely during winter and especially during early spring.

The Role of Ensilage relative to Utilization.

In many instances both of the conditions which lead to poor utilization of pastures, though radically different, can be corrected to a valuable extent strangely enough by the one operation—ensilage. Ensilage enables the summer surplus feed to be held for use during the customary period of shortage in winter and early spring. Though ensilage grows in popularity—the latest official figures, those for 1932–33, disclose the greatest area yet recorded—there is still much room for profitable expansion in the area harvested annually for silage in most districts in which grass dominates farming. Ensilage seems too often to be viewed merely as a means of building up reserves of feed. It is a valuable means of doing this, but it is at the same time possibly more valuable as a means of controlling and modifying the natural development of pastures in summer. To be as effective as possible in this latter role, ensilage as a rule should be carried out at an earlier time than has been adopted commonly. Ensilage usually should be carried out before the time favoured for haymaking, which itself is generally too late. If ensilage is carried out at a suitable date there will be, firstly, the possibility of silage of better quality, and, secondly, the greater likelihood of a satisfactory vigorous, leafy aftermath, providing highly digestible feed when often it is sorely needed. In addition, ensilage, properly exploited, has a beneficial effect on all other pastures on a farm—by disposing of surplus growth it minimizes the development of mature growth on the farm as a whole, and the pastures tend to be more productive and leafy in the latter part of the summer than they would be otherwise.

Systematic Grazing desirable.

For the fullest efficiency in pasture utilization, it is necessary usually to link ensilage with well-planned grazing, which at times should be supplemented by the topping of any growth which, without such treatment, tends to run to seed-heads. As a rule, highly effective grazing management may

be achieved on farms on which nine to twelve fields of fairly even carrying-capacity are in pasture, and remarkably good results are being obtained on such farms. Full particulars about effective grazing and other aspects of pasture utilization may be obtained from local officers of the Fields Division, whose advice, based on a consideration of local conditions, is likely to be more helpful than would be the generalized guidance such as is possible in these notes.

To enable grazing to take place at the most suitable stage of growth it is necessary at an appropriate time to drop from the grazing programme any paddocks in excess of those required to meet the current feed requirement of the stock. Much of the poor utilization that is tolerated is due to not dropping enough of these paddocks or not dropping them soon enough. And it is the appropriate dropping of these paddocks which provides the scope for ensilage, for usually it is desirable to drop from the grazing more paddocks than could be utilized effectively for haymaking. Early closing of fields for ensilage is valuable in that it favours the possibility of early mowing, which in its turn gives greater probability of a good aftermath. A top-dressing with superphosphate at closing-time of fields intended for ensilage or haymaking is often advisable, especially in the case of fields not recently top-dressed.

The Potato Crop.

It is probable that annually more disappointments are experienced in respect to the potato crop than to any several other crops grown in the Dominion. Because of these disappointing crops the average potato yield is much lower than it need be. The average Dominion yield is between 5 and 6 tons an acre, and, when it is remembered that much of the land sown in potatoes yields 10 tons or more an acre, it is obvious that there must be many crops of miserably low yield.

There is abundant evidence that much of the occurrence of these " scrub " crops is due primarily to inferior seed. To remedy the position an official system of certification of seed potatoes was inaugurated a few years ago. The need for certification arises from the fact that the essential characteristics of good potato-seed fall into two principal classes. One class includes characteristics which may be judged from the appearance of the tubers, such as the purity and maturity of the seed, the size and shape of the tubers, and freedom from such diseases as scab and late or Irish blight. The other class includes a very important characteristic about which the appearance of the seed tuber tells nothing in practice. This is the presence or absence of obscure troubles which are known as virus diseases, and which can be detected in the field only by personal inspection of the growing plants. The virus diseases may be looked upon as a primary cause of the so-called " running out " of potato varieties.

The association between virus infection and yield was well illustrated in a trial carried out last season at the Plant Research Station, Palmerston North. This trial primarily was designed to give growers information relative to complaints that had been received about the table quality of certain potatoes grown in the North Island. The complaints related particularly to the condition generally known as brown fleck. The trial not only clarified the brown fleck question, but also exemplified the connection between virus and yield. In considering the yields obtained in this trial, it is important to remember that the only variable circumstance was the productive capacity of the seed. In all other matters of consequence such as soil, manuring, and cultivation there was uniformity. Hence particular significance attaches to the range in yield.

The comparatively early strain of Sutton's Supreme, known as Aucklander Short Top, varied from 14 tons to 5 tons per acre. In the 14-ton crop there were 4 per cent. of diseased plants. In the 5-ton crop there were 44 per cent. of diseased plants or misses. Virus trouble was almost wholly, if not wholly, responsible for both diseased plants and misses. The late strain of Sutton's Supreme, known as

Aucklander Tall Top, ranged from over 16 tons to under 7 tons per acre. The 16-ton crop had 2 per cent. of diseased plants, the poor yield was associated with 78 per cent. of diseased plants or misses. The Iron Dukes, which are also called Aberbrothock, ranged from 15½ tons to under ½ ton an acre. In the crop of heavy yield there was little virus trouble, while in the failure every plant was diseased. It seems worth stating again that the only variable factor with which these striking differences in yield can be associated is the virus incidence in the seed. From this it follows that the influence of excellent judgment in respect to soil and cultivation and judicious expenditure in respect to fertilizer can be completely neutralized by neglect relative to seed.

The information yielded by the trial in respect to quality is also well worth consideration. Ten lots of seed were wrongly entered as Iron Duke: they really were Northern Star. In other lots Northern Star occurred freely as an impurity. The point of importance in this confusion relative to variety is that Northern Star is lacking in quality because of brown fleck, whereas good seed of Iron Duke is quite satisfactory in this respect. Hence, if the growers were using the variety they believed they were using the complaints regarding quality would not have been received.

The question of practical importance is, "How can growers make sure of obtaining seed satisfactory in respect to virus trouble and true to name?" The answer is, "Use certified seed." The great body of those who grow potatoes that is, those whose crops are designed primarily to meet their own private needs—could well give more attention to the use of certified seed. To facilitate this, certified seed is being sealed for sale in small lots—from 14 lb. upward.

The cutting of seed potatoes at times leads to misses in the rows, due to the rotting of the cut portions. Rotting is greatly minimized when conditions are suitable for the healing of the cut surfaces. Dry conditions are particularly unfavourable for healing. Hence, while it is good practice to cut and plant seed immediately into a moist soil it is not good practice to leave cut potatoes in sunlight or to plant them at once into dry soil. If cut seed are to be kept for a day or so they should be spread out loosely—as air facilitates healing of the cut surfaces—and covered with wet sacks. Of popular varieties, Aucklander Short Top, Aucklander Tall Top, Majestic, and King Edward do not heal readily after cutting, and so need special care.

Treatment of Cereal Seed.

It is very inadvisable to omit treating cereal seed suitably for the prevention of smut. For many years wet pickles such as solutions of bluestone or formalin were widely used for this purpose. These, while definitely useful for holding the smuts in check, have at times led to injury to germination or to checking of the growth. Because of this, the modern tendency is to resort as far as possible to the use of various chemicals in dust form. The chief advantages of the dusts are the elimination of the danger of seed injury and the ease of treating and subsequently handling the seed. Disadvantages of the dusts are extra cost and the danger of injury to workmen carrying out the dusting. Regarding these disadvantages, it is well to remember that the extra cost is at most under a shilling an acre, and that dusting either can be done at home by suitable machines costing under £2 or be undertaken by seed-cleaning plants at a cost covering little more than labour and material.

Unless seed-treatment is carried out properly, it is very likely either to cause serious injury to the seed or to be ineffective as a means of reducing disease. Mistakes may relate either to the material used or the methods followed. As an example of this, copper carbonate dust, while

normally effective in wheat, is not effective with barley or oats. On the other hand, organic mercury dusts are effective for all smuts of cereals, except loose smuts of wheat and barley, which are controlled only by suitable hot-water treatment.

General Cropping Work.

As September is often a suitable time to close up lucerne areas, any delay in doing this as a rule should now be avoided. Early closing assists greatly in obtaining a comparatively early cut which generally is saved suitably as silage followed at about new year by a second cut which is valuable either for hay or green feed. A common result of early closing is an extra cut annually from the lucerne. A further important result in lucerne crops which are invaded by plants that outgrow lucerne early in season is the removal of the harmful competition of these plants which normally lucerne outgrows in the summer.

It is often worth while to sow in October an area of quickly-maturing soft turnips, such as Purple-top Mammoth, for use early in the new year. The yield from such an area may not be heavy, but it is likely to be particularly useful in obviating unduly rapid falling-off in milk-production. Shortly after the sowing of the early variety the remainder of the soft turnip area may be sown in late-maturing varieties such as Imperial Green Globe.

Kales, including chou moellier, or marrow-stemmed kale, have been sown with good results in October, when they have provided feed towards the end of January or the beginning of February. Later sowings of kales may well be made to yield feed for use in the autumn and winter. Strictly because of its merits, chou moellier has increased in popularity in recent years. A suitable sowing is 1½ lb. to 2 lb. of seed an acre sown broadcast or ½ lb. to ¾ lb. in drills 2 ft. to 3 ft. apart. Chou moellier demands and deserves high fertility and usually responds very profitably to a dressing of 2 cwt. to 3 cwt. an acre of superphosphate on good land—a dressing which on land tending to be poor may often well be supplemented by 2 cwt. an acre of blood and bone.

Thorough preparatory cultivation should be the keynote of all cropping operations. Year after year much evidence is provided that potential returns from judicious action and outlay in respect to all other phases of cropping are far from fully realized because of inadequate cultivation.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Control of Pests and Diseases.

By the time these notes appear, the blossom buds on most pome-fruit trees will be at about the open-cluster stage, while early flowering varieties, particularly of pears, will be at the pink stage, with a few of the early blossoms fully opened. This is one of the most important periods in the season for the application of fungicidal sprays, particularly for the control of powdery-mildew on apples and black-spot on apples and pears. Varieties of apple-trees that are subject to either of these diseases should receive at least two applications of lime-sulphur during the pre-blossom period, the first at the tight-cluster stage, at a strength of 0·2 per cent., and the second at advanced-pink stage, at a strength of 0·1 per cent.

For the control of powdery-mildew it is important to reduce the period between the last pre-blossom spray and the first post-blossom spray as much as possible. It is during this period that the disease often becomes established on the young growth. If the advanced-pink application is delayed until about 10 per cent. of the blossoms are fully open, and the petal-fall application made when only about 75 per cent. of the blossom

petals have fallen, there is little risk of the fungus becoming established during this dangerous period. The petal-fall spray should consist of the following combination: Lime-sulphur, 0·1 per cent.; colloidal sulphur, 2 lb. per 100 gallons; lead arsenate, 1½ lb. per 100 gallons.

On pears, excepting for a few tender varieties, bordeaux mixture at a strength of 3–4–50 is recommended from this period onward.

The first and second applications after the petal-fall spray should be repeated at intervals of ten days and fourteen to eighteen days respectively. It is advisable to make later applications at intervals of fourteen to twenty-one days, and the only alteration needed in the mixture is a reduction in the strength of lime-sulphur to 0·083 per cent. These spray applications should be continued until mid-January or later according to conditions.

The nymphs of the apple leaf-hopper usually appear on the under-side of apple foliage during October, and by sucking the juices from the leaves prevent the foliage from functioning as it should. This injury is liable to be reflected in the size of the fruit and the development of fruit-buds for the following year. Control can be effected in the nymph stage by the addition of nicotine sulphate 40 per cent., 0·05 per cent. (1–800) to the fungicidal sprays mentioned above.

Stone-fruit trees will now generally be in bloom or have passed the blossoming period, and, no doubt, will have received the pre-blossom spray for the control of leaf-curl, bladder-plum, shot-hole, brown-rot, &c. The disease most likely to cause loss after this stage is brown-rot, but this loss can be prevented in a large measure by spraying with lime-sulphur, 0·083 per cent. plus colloidal sulphur, 2 lb. to 100 gallons. The petal-fall application is very important, and then follows a period when usually little trouble is experienced and an application every fourth week is all that is necessary. The last month before the fruit ripens is the most difficult period in which to effect control, and applications should gradually be increased to intervals of ten to fourteen days as maturity approaches.

With the first appearance of any kind of aphis, nicotine-sulphate 0·05 per cent. (1–800) should be applied Where it is intended to apply this specific alone, the addition of what is known as an activator is of importance. Hydrated lime or soft-soap are suitable activators when used at 3 lb. to 4 lb. per 100 gallons of spray. Should the application be made in conjunction with a sulphur spray, the addition of an activator is not necessary. It is suggested that the required amount of nicotine sulphate be placed in 2 to 4 gallons of water to which the activator has already been added, and allowed to stand for twenty minutes before fully diluting. This procedure of mixing will result in greater efficiency. More effective control will be obtained if the application is made on a hot day, consequently it is advisable, where possible, to await suitable conditions.

Refurnishing Apple-trees.

Refurnishing is a term used to describe a comparatively new method of working over a tree from one variety to another. This method is being experimented with by many growers in this and other countries. The object of refurnishing is to obtain a tree of the desired variety capable of producing a full crop of fruit in a much shorter space of time than is possible by the old method of cutting down the trees to near the base of the trunks and crown-grafting. Trees to be refurnished are prepared by reducing the leaders to about eight or less in number. All arms, laterals, and spurs are removed and the leaders reduced in height to a point where the wood is of suitable thickness for whip-grafting. Scions arranged spirally along the entire length and spaced about 1 ft. apart are inserted into the sides of all leaders. Several hundred scions are necessary in refurnishing a large tree.

There are many different methods of inserting the scions when refurnishing trees. A method that so far appears to be one of the most successful is known as the inverted L or side graft. A cut the shape of an inverted L is made in the bark, the corner of the L is raised and the scion pushed under

the uplifted portion of bark. The scion is made of the same shape as that used for rind grafting and held in position by a nail which is driven through the covering bark and the scion. Fine gauge nails about $\frac{5}{8}$ in. in length are suitable for the purpose. It is necessary to remove a small portion of bark above the heel of the L so that the scion will fit closely.

Some experimenters claim that in refurnishing it is preferable to place the scions on arms and laterals rather than on the leaders. However, time alone will produce more definite information on this point. With the inverted L system no bandaging is necessary and the operation is very simple. The wounds where the scions are inserted should be sealed with grafting-wax or thick crude petroleum jelly, the latter usually giving excellent results. Trees should be in the same stage of growth for refurnishing as for ordinary grafting, and the scions in a dormant state.

Pollination.

Good pollination plays an important part in the setting of fruit. Honey-bees are probably the most important of the pollen-carrying insects, consequently no orchard should be without a few hives. One colony of bees to every 2 acres of orchard should be the minimum number kept. In large areas the hives should be distributed in various parts of the orchard. This is most important when showery weather is experienced during the blossoming period, for usually when rain is threatening bees will not travel far from the hive. Certain varieties of apples and many varieties of pears and plums are largely self-sterile and require pollen from another variety to produce fertility. In such cases pollination may be assisted by taking blossom twigs from another suitable variety and suspending them in the trees requiring pollination. If the twigs are placed in containers with water they will remain fresh for several weeks.

Tree-supports.

In many orchards large fruiting limbs are broken each year for want of adequate support. In past years wooden props have been used generally for this purpose, and in some orchards they are still employed extensively. These props cause considerable inconvenience and are a heavy annual expense. A permanent system of wire-bracing is far preferable in every way. Full details of a system of central wire-bracing fruit-trees appeared in this *Journal*, November, 1932. Any such permanent bracing should, if possible, be done before the blossoming period.

Fireblight.

A thorough examination for fireblight cankers should be made as soon as possible, more especially in pear-trees and hawthorn-hedges. The first sign of new infection of fireblight is the wilting of blossom clusters and is to be expected especially in late-flowering varieties. Constant vigilance for the first sign of blossom infection is of the utmost importance in the control of the disease. The immediate destruction of infected blossom clusters, together with the spur on which the blossom is found, is the only means of control at this period. Any such infection that may be found should also be immediately reported to the Orchard Instructor for the district so that efforts can be made to locate the hold-over canker responsible for the outbreak.

Miscellaneous.

Cultivation should be proceeded with as soon as the condition of the land will permit, and a good tilth secured early in the season. This practice renders cultivation unnecessary when the trees are in full bloom—such cultivation should be avoided when possible.

Fruit, particularly pears, in cool stores should be examined frequently, and marketed before they become overmature.

—*P. Everett, Orchard Instructor, Gisborne.*

Citrus Notes.

Some attention should now be given to the pruning of citrus trees. In many orchards there is considerable room for action in this respect. Overcrowding of branches, bare and useless wood, are matters that need attention. Sunlight and air are both very essential to maximum success, and without them proper development cannot take place. In old trees where branches are crowded some of them should be taken out, and, in addition to this, all exhausted and dead wood should be removed. All long laterals should be shortened, and this will have the effect of producing short fruiting-wood. The principal object in pruning should be to lead to the production of the maximum quantity of fruit in as compact a space as possible. Trees with a limited number of well-spaced leaders studded with suitably healthy laterals often will produce more fruit than those trees that are densely wooded. Further, it is more likely that the fruit will be of a higher quality and of more even size by reason of the fact that it has been produced under better conditions. Where planting has not been completed no time should be lost in getting the trees in position in order that they may become established before the hot and dry weather commences.

At this season of the year the trees will benefit greatly by receiving a liberal dressing of manure. As animal manure is practically unprocurable, it will be necessary to use artificial manures. It is very difficult to specify treatment that will give general satisfaction. Phosphates, potash, and nitrogen are all necessary for the tree and fruit. Where fertilizers such as superphosphate or blood and bone are being used, every effort should be made to have them turned under, as these fertilizers move down into the soil very slowly. However, sulphate of ammonia and nitrate of soda can be sown on the surface and worked in, as they are readily washed into the soil. Mature citrus trees require greater quantities of nitrogenous manure. As far as it is possible financially the application of fertilizers should not be neglected, as it will be quickly reflected in the health and vigour of the trees.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Hatching Chickens.

Poultry-keepers who have not yet the desired number of chicks hatched, or the last eggs for the season undergoing incubation, are reminded that chicks hatched later than the end of the present month, or early in October at the latest, seldom prove satisfactory. No time, therefore, should be lost in securing the required number of young birds for the season. In many cases hatching operations will probably be delayed for several weeks to come owing to the inability to secure broody hens. The wise poultry-keeper, however, who realizes the drawbacks of having late-hatched stock in the plant will not wait for broody hens. He will either adopt artificial methods of hatching or procure day-old chicks and rear these by means of an up-to-date brooder. It is now recognized that the maximum returns cannot be secured from poultry unless eggs are produced freely in late autumn and winter. It is also recognized that the pullets chiefly must be depended upon to produce eggs at these seasons, and to do so the chicks must be hatched by the end of September at the latest. The drawbacks of late-hatching are many, but these may be largely counteracted by placing the chickens under the very best conditions possible, such as in an orchard where good shade, shelter, and fresh ground are available. In addition, the food supplied should be of sound quality, and, above all, an abundant supply of succulent green material, that great essential for their welfare, provided for the young birds.

Ducks for the Farmer.

October is a very suitable month during which to hatch out the laying type of duck. The keeping of a small flock of ducks is a matter which should appeal particularly to farmers and small settlers, for it is on farms and small holdings, where plenty of range is available, that the maximum profit can be made from a flock of ducks of high laying-capacity. It may be said that ducks are heavy feeders, and with the present high cost of food will return a poor margin of profit over their keep. This may be true where the whole of the food they require has to be purchased. On the farm, however, it is entirely different, for where a free range is available, and particularly where there are creeks and the land is swampy, ducks will at most times of the year find a good deal of the food they require. Again, on the small holding where skim-milk or milk-curd is available this forms a splendid food for ducks of all ages.

Probably the two most popular breeds of duck in New Zealand at the present time are the Indian Runner and the Khaki Campbell. The latter may be regarded as a much better dual-purpose breed than the former. Both of these breeds are good foragers, when given their liberty, and the worms, snails, and other forms of insect life, combined with green material picked up, make ideal food for promoting egg-production. Compared with fowls, the cost of accommodating ducks is much less. In most parts of New Zealand they do not need houses, as a low wire-netting fence about 3 ft. high erected in a dry, well-sheltered locality is all that is required. This is merely for the purpose of yarding the birds by night. Owing to the fact that ducks usually lay their eggs at night and drop them anywhere, the work of collecting would be a troublesome matter were the birds not enclosed, to say nothing of the eggs that probably would be lost. Ducks should be kept penned until about 10 a.m ; few, if any, eggs are laid later. Ducks are creatures of habit, and if given a good feed at a regular time in the evening they can generally be depended upon to come home and then they can be penned up for the night.

Hatching Ducklings.

If the temperature in the incubator at the level of the top of the eggs is maintained at 102° the first week, and at 103° from then onwards, the eggs should start to pip on the twenty-sixth day and hatch out from thirty-six to forty-five hours later. Far too many people became alarmed at the hatch being delayed for this length of time after the pipping stage, and attempt to assist the ducklings out of the shell. This is a great mistake, as opening the machine and interfering with the eggs in any way before allowing them well over their full time of hatching is only inviting trouble.

One of the secrets in hatching duck-eggs is the application of moisture. The best way of applying this is to spray water at a temperature of 103° on the eggs with the mouth every morning after the fourteenth day. It is advisable to do this after turning and immediately to place the eggs back in the machine. Do not cool after spraying. Spray in the morning, and cool at night.

Brooding Ducklings.

Ducklings being reared under artificial conditions should be given water to drink with the first meal, and from then onwards water should be left within reach of the birds during both day and night. It is of the greatest importance that after a long fast they be not given water until they have received a meal. Even then it is a wise course to provide water with the chill taken off. When ducklings are given a cold drink before food, and especially if they have been confined in a brooder without food, they are almost sure to suffer from staggers, followed by heavy mortality. Ducklings thus affected give every indication of being in a fit by falling on their backs with eyes twitching, and presenting generally a distressed appearance.

They sometimes behave in a similar manner and with serious losses when enclosed in an overheated, badly ventilated brooder. Even when ducklings are first placed in the brooder it should be so arranged that the desired heat can be secured without excluding fresh air. Good food and cleanliness are certainly essentials in rearing ducklings, but even these count for little if the birds are placed in a brooder that is insufficiently ventilated. During the summer season, artificial heat, if reduced by degrees, can usually be dispensed with altogether when the ducklings are about three weeks old. Climatic conditions must at all times be taken into consideration. In favourable weather the ducklings may be let out of the brooder and given a limited run both by day and night on the third day after removal from the incubator. Food is not required for at least thirty-six hours after hatching. The first meal may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, to which a handful of fine grit should be added. The grit assists in the proper digestion of the food. Feed this mixture four times a day, giving all the birds will clean up. When they are a week old the grit need not be mixed with the food, but may be kept in a shallow dish or tray, so that they may eat as much as they require. As they grow older grit of a coarser size should be supplied. From the time they are a fortnight old they should be fed three times a day with equal parts of pollard, bran, and maize-meal, and it is advisable to continue giving this ration until the drakes are ready to kill. When the birds are a few days' old, finely cut green food, such as lettuce, young tender grass, or silver beet, should be fed daily. If skim-milk is available it may be used to advantage for mixing up the morning mash.

Although ducks are water-fowl, it is important in respect to old or young birds that their sleeping quarters be maintained in the driest possible condition, or leg-weakness and other troubles will result. After about three or four days the water-vessels should be placed well away from the sleeping-quarters as a means of minimizing the wetting of the latter. At this stage the vessels should be of sufficient depth for the birds not only to wash off any food or dirt from their nostrils, but at the same time to give them a "good blow out." If the nostrils are allowed to clog the eyes become plastered, while lameness, weak back, and an unthrifty condition soon set in.

On account of the thinness of their skulls, ducklings are very subject to sunstroke and giddiness, and therefore shade should always be provided. When very young, as is the case with chickens, young ducklings should be marked for future age-determination. The best way of doing this is to take a V-shaped piece out of the edge of the web of the foot. This should be done with a very sharp knife, the foot of the duckling being held firmly on a piece of solid smooth board during the operation. Ducklings can be marked when leaving the incubator.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Seasonal Preparations.

OCTOBER is perhaps the month when the apiarist can most greatly help his bees to develop to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be expected about the middle of the month, but in the southern districts they probably may not appear until three or four weeks later. By 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined and its condition noted with regard to stores, population, and health.

NO colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. On the other hand, some beekeepers prefer that all the old honey in the hive should be used

up before the new season's flow commences. The food-supply of the hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examinations can decide the question as to whether all is well with the hives in this respect. No harm can be done by feeding good white-sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, as everything depends on locality and weather conditions. In some districts it would be most inadvisable for the beekeeper to treat his bees in October; in others, where suitable conditions prevail, treatment may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding. For full details see Bulletin No. 119 "American Foul-brood and its Treatment." This is issued free, and can be obtained from any of the Department's offices.

Hiving Swarms.

In most textbooks on beekeeping this type of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. Such advice is sound where the bees are accommodating enough to settle into a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb up into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoke must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box, with the brush used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm has settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise before the close of the day the probabilities are very largely in favour of the box being taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate. In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

Water-supply.

One of the most important of the minor details of apiculture is the provision of a constant water-supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing his drinking-fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Plant Preferences.

CROP-PLANTS collected from many parts of the world bring with them a preference for the conditions of temperature, moisture, soil acidity, and foods to which they are accustomed. Successful cropping depends very largely in learning these requirements and supplying them. Recently improved methods of measuring the acidity of a soil have enabled important contributions to be made to our knowledge of the preferences of many crops in this respect. Many are aware of the fact that after a dressing of lime sufficient to neutralize the acidity of an acid soil, cabbage, cauliflower, broccoli, Brussel's sprouts, rape, mustard, and turnips, clovers and barley at times give much improved results. We have now to add sweet corn, tobacco, and egg plants to the list, the last two being members of the botanical order of *Solanceae*, many members of which are very tolerant of acid soil conditions. Recent reports indicate that even more sensitive to acid soil conditions than those crops mentioned above are asparagus, beet, celery, lettuce, onions, parsnips, spinach, leeks, salsify, and currants.

Many crops are less particular, and give satisfactory returns on soils slightly acid or alkaline. Under this heading are listed carrots, radish, cucumbers, endive, lentils, peas, pumpkins, marrows, water-melons, rhubarb, tomatoes, beans, Brussel's sprouts, choko, kohl-rabi, turnips, crimson clover, vetches, gooseberries, grapes, red raspberries, and strawberries. Plants which do best in slightly acid soils or are said to be very tolerant of that condition are beans, potatoes, sea kale, radish, water-melons, parsley, kumara, tomatoes, maize, black raspberry, blackberry, strawberry, cow peas, rye, oats, and lupins.

It will be noticed that some crops are listed under two headings. Such instances indicate the conclusions of different authorities. Where difficulties are being met in cropping it would be well to consider the position in the light of the above information. The very human tendency of rushing to extremes must be avoided; it is so easy to believe that if a thing is good one cannot have too much of it. Overliming is generally unlikely to take place to any extent owing to the cost of the lime, but, to get the best results, the heavier dressing especially should be mixed well in the soil some time before sowing the crop. Crops which tolerate or prefer a slightly acid soil do not usually do so well on a very acid soil. Under such conditions a dressing of lime can be made with advantage and without neutralizing acidity altogether. This should be remembered in regard to the strawberry, tomato, and potato crops especially. In this regard it should be remembered that lime is used up, or leaches out, of soil fairly rapidly, and turning in green cover crops has the effect of increasing acidity, so that, even in the case where crops preferring a slightly acid soil are to be grown there is no reason why the practice of liming the soil and obtaining its valuable mechanical and chemical effects should be avoided so long as it is done with good judgment.

Vegetable Crops.

In warm districts short carrots and globe beet sown in early spring and autumn maintain a good supply of tender roots throughout the year; but in districts too cold for satisfactory autumn-sown crops of these vegetables for winter use, good sowings of a variety of intermediate carrot and long red beet should be made during the month of October. These will mature late in the season without becoming coarse. The planting of main crop potatoes should also be completed.

Towards the end of the month seed-beds should be sown down with savoy, red cabbage, and cauliflower; and, more especially in the colder districts, broccoli and kale. Out-sizes are not popular in vegetables of this kind; moderate-sized specimens of good flavour should be the aim. Such are planted closer than the larger kinds and so there is little, if any, loss in yield. It is advisable to sow the seeds thinly; and to protect carefully the young plants from pests so that sturdy plants will be available for planting out in December and January on land from which early crops have been removed. Diamond-back moth will have the assistance of the white butterfly in many districts for the attack on this group of crops. The attack may be prevented most effectively in practice by dusting the young plants lightly in early morning or during the evening, when a light dew is on them, with 1 part of powdered arsenate of lead and 5 parts hydrated or air-slaked burnt lime thoroughly mixed. In small gardens where a mechanical blower is not available, the powder may be placed in a wide-mouthed bottle with a fine-meshed cloth covering the mouth. The cloth should be loose enough to enable a cork to be inserted when the bottle is not in use, and tied round with galvanized wire. This treatment is recommended by the Assistant Entomologist at the Plant Research Station, Palmerston North, who has been experimenting with the different methods of preventing the serious damage that may be done by these insects.

In the warmer districts plants of marrow, cucumber, and melons, raised under glass, may usually be planted out towards the end of October in a light rich soil; or seeds, including pumpkins, may be sown in all districts where the conditions are suitable. It is important that a sunny well-sheltered position be chosen for these and other half-hardy crops. These include maize—sweet corn—which is rapidly winning popularity, and dwarf and tall beans for cooking green in the pod, or as flageolets (ripe and shelled), or as dried beans, thus supplying a variety of attractive dishes for the whole year round. The dwarfer varieties, such as Pale Dun, Feltham Prolific, and Stringless Green Pod, grown now on account of their relative immunity to wilt disease, should be sown a little thickly in rows 2 ft. apart.

A sowing of celery should be made now for the late crop, and of spinach and salads so that they will be well forward before the dry weather arrives. In dry districts New Zealand spinach should be sown now outside, or plants set out from boxes. It is of excellent colour when cooked and of mild flavour, and provides a bountiful clean crop under conditions that would be disastrous to most other crops of the class. The only other crop of the kind for such conditions is what is known here as silver beet, plants of which may be set out now.

Tomatoes, Egg Plants, and Peppers.

These half-hardy annual fruiting-plants require a warm sheltered position. As with most plants that are required to carry fruit almost immediately, they must not be grown too rankly; so nitrogenous manures must be used with discretion and overwatering and high temperatures avoided under glass. This does not mean an overcropped soil nearly destitute of humus is suitable for these crops, as too little nitrogen is as bad as too

much. Sufficient is required to grow a normal plant, and, when the fruit is set, more can then be given in solution if large-sized fruits are desired. Before planting, the nitrogen is best supplied in an organic form, such as farm manure, green crops, or blood manure, and, where heavy manurial dressings are the custom, a portion of the supplies of phosphoric acid also are best supplied in an organic form as bone or fish manure, with a proportion of soluble phosphates for the more immediate use of the plants in the form of superphosphate. Sulphate of potash also is applied—it stiffens the tissues and induces fruiting, and so is complementary to the action of the nitrates which alone or in excess produce soft, barren growth. It is for this reason that sulphate of potash is used rather liberally for such crops as these. In warm localities safe from the danger of late frosts the plants just considered may be set out towards the end of October ; elsewhere it is often the beginning or middle of November before this may be done satisfactorily. In preparation the manures should be turned under when ploughing or digging, and the fertilizers, two or three weeks before planting, should be worked in with the cultivator.

If sturdy plants that have never been checked in their growth are then set out, the average results should be satisfactory. Set the plants deeply and firmly, but they should not at all be tight round the collar. Tomato plants outdoors are planted a foot apart with about three feet between the rows. They should be rather farther apart in the rows where the plants are trained to stakes, as in the more sheltered localities, and rather closer when the plants are trained on a wire trellis. Egg plants are set about two feet apart in the rows and peppers rather closer. It is advisable to make sure that the plants are well hardened off, and to set them out with as little disturbance of the roots or exposure to the air as possible.

The important functions which take place in the leaves of plants cause a great quantity of water vapour to be given off when active growth is taking place ; this means that in a confined space almost filled with growing foliage, as in the case of a tomato crop under glass at this season of the year, a very humid atmosphere is set up, which, while being very suitable for cucumbers and other crops, is most detrimental to the tomato crop, which requires a comparatively dry atmosphere. This can be obtained under the circumstances only by giving ample ventilation along the ridge of the house to allow the heated moist air to escape. So long as weather permits, a little ventilation may now be given during the night, and this should be increased greatly early in the morning before temperatures rise unduly, taking care to avoid cold draughts. Instead of the foliage being thin and soft, and subject to leaf-mould, it will then be firm and stout and little subject to the attack of this fungus if the house has been properly cleaned immediately after the last harvest. As this disease causes serious loss annually, careful attention should be given to it, especially in warm humid districts. Watering is best done in the early morning.

Small Fruit Crops.

The harvesting of the choice berry crops commences with culinary gooseberries towards the end of October, followed by strawberries, raspberries, loganberries, and currants during the summer months. The perishable nature of some kinds of these fruits makes satisfactory distribution rather difficult. The old system of booking orders in advance for delivery in season is excellent under some circumstances, and might be used more with advantage to all parties.

Tree tomatoes (*Cyphomandra betacea*), passion-fruit, and Cape gooseberries may now be planted out in good land that is well sheltered from wind in warm localities.

The Homestead Garden.

Rose-trees, after pruning, sometimes make strong growth in undesirable positions : if such new growths are now removed the plants will be better

balanced and the well-spaced growth remaining will have a better chance of developing. Prune heaths, rhododendrons, brooms, acacis, and boronias after flowering; it is usually sufficient to remove only the seed heads from rhododendrons. Use now a good weed-killer on the walks and drives. Harden off bedding-plants so that they will grow without a check when planted out. Complete the preparation of the ground in which they are to be planted by working in a dressing of fertilizers. Late October for warm districts and early November for the colder are early enough to plant out half-hardy annuals, dahlias, and chrysanthemums in well-prepared ground.

Handsome winter-flowering herbaceous plants are the hellebores; they thrive in a rich moist soil that is rather shaded. They are suitable for the shrubbery or rock garden, and dislike being disturbed when once established. They may be planted out now. Following is an interesting note from a contemporary regarding the popular alpine *Gentiana acaulis*. To make these plants produce the large rich blue trumpets in abundance one should "after planting tread the soil as hard as possible and never hoe it." This advice from a grower in Great Britain who has unusually fine results should be tried to see if it suits local conditions.

—W. C. Hyde, Horticulturist, Wellington.

APPOINTMENT OF DIRECTOR, FIELDS DIVISION.

CONSEQUENT upon the retirement of Mr. J. W. Deem, Mr. R. B. Tennent, N.D.D., has been appointed Director of the Fields Division of the Department of Agriculture. Mr. Tennent had some experience in farming practice in Scotland before proceeding to Queensland, where he was a student in the Queensland Agricultural College for two and a half years and subsequently Manager of the Warren State Experimental Farm, Central Queensland, until his departure for active service. After the war Mr. Tennent gained the National Diploma in Dairying as a result of his studies at the West of Scotland Agricultural College, and then returned to Queensland before coming to New Zealand,

Mr. Tennent for a period held the position of Instructor in Agriculture to the Otago Education Board, which he left in 1920 to accept an appointment as Instructor in Agriculture in the Department of Agriculture. In this position his duties embraced work in Otago and Southland. One of the major tasks that he was called upon to deal with related to the problems arising in respect to the extensive irrigation ventures in Central Otago; and in connection with this task, in 1923, on behalf of the Department of Agriculture, he investigated irrigation schemes in Australia, and again in 1925 he visited the United States of America, with an engineer of the Public Works Department, to study the bearing of irrigation in that country upon the irrigation projects in New Zealand. In 1933 he was appointed the Government representative upon the Taieri River Trust.

In 1928 he was appointed Fields Superintendent of the Department of Agriculture at Dunedin with supervision of the wide range of activities of the Fields Division in Otago and Southland. This position he occupied until his recent appointment as Director of the Fields Division.

Dairy Production in 1933–34.—The following information relative to the estimated dairy production in New Zealand in 1933–34 has been compiled by the Farm Economics Section, Department of Agriculture—the numbers in parentheses indicate the corresponding returns for the 1932–33 season: Total dairy cows in milk and dry, 1,932,511 (1,845,972); total dairy cows in milk only, 1,816,402 (1,723,913); total production in butterfat, 426,699,242 lb. (397,068,707 lb.); average annual production for all cows in milk and dry, 220·80 lb. (215·10 lb.); average annual production for cows in milk only, 234·91 lb. (230·33 lb.). The estimated average production per cow in 1933 is the highest yet recorded.

WEATHER RECORDS: AUGUST, 1934.

Dominion Meteorological Office.

THERE were two sharp cold snaps in August each associated with widespread snowfalls, the first shortly before the middle and the second before the end of the month. The second was the more severe, owing especially to the southerly gale which accompanied it. The remainder of the month, however, was mild and spring-like, and mean temperatures were, in general, somewhat above normal. A good deal of showery weather occurred, and the amount of sunshine experienced was less than usual. Rainfall was generally above average in the South Island, but below it in the North. Though, in some districts, there were heavy losses in the cold spell towards the end of the month, the lambing season is proceeding favourably. Pasture is plentiful for the time of year and stock are reported to be in very good condition. In Canterbury, the wetness of the soil has prevented the sowing of wheat crops over large areas, and the work on other crops is behindhand. Signs of spring in bird and plant life are numerous. White butterflies are already appearing in large numbers.

Rainfall.—As stated above, the month was a dry one over most of the North Island, eastern districts, from the Wairarapa to East Cape, particularly, receiving much less than the average fall. Parts of North Taranaki, the Bay of Plenty, and an area round Wellington, however, had rather more than the average; while in the extreme north there were some very heavy falls. In the South Island, most districts experienced a very wet month, but in Southland and the eastern portions of Otago and South Canterbury isolated areas recorded less than the average.

Temperature.—At a few places on the east coast the mean temperature was very slightly below normal, but over the rest of the country the normal was exceeded. The departures from the normal were generally slight. Frosts were fairly numerous and occasionally severe, but there were some beautifully mild days.

Sunshine.—The amount of bright sunshine fell considerably below the average for August.

Storm Systems.—There were only three storms of any severity. A shallow depression which crossed the Dominion during the 5th and 6th caused considerable rain during its passage, especially in the far north and north-east. The disturbance rejuvenated, however, when it was to the eastward, and there was an outpouring of cold air from the south over New Zealand. Snow was widespread on the 9th, though it did not lie long at low levels. The weather became very cold, and severe frosts followed on the 10th and 11th.

A second depression, which had a considerable extension in a north to south direction, was responsible for northerly gales on the 15th and 16th and heavy rain fell in places. Snow was reported in places on the 17th after the depression had passed.

The worst weather in the month resulted from a cyclonic depression which moved in a south-easterly direction across the Dominion on the 22nd and 23rd. It was responsible for general rain with many heavy falls. After it passed, on the 24th and 25th a southerly gale extended over most of the country. Heavy snowfalls occurred on all the high levels, and in the interior of Canterbury it lay for several days on some of the plains. Frequent hailstorms were experienced at many places. Severe frosts followed until the 27th, but thereafter until the end of the month the weather was mainly beautifully fine and mild.

RAINFALLS FOR AUGUST, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.	Total for Year to Date.	Average for Year to Date.
	North Island.					
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	8·31	13	2·08	5·12	42·24	38·76
Russell	13·26	15	3·98	4·70	56·27	37·30
Whangarei	5·93	19	1·15	6·31	43·26	45·10
Auckland	2·95	15	0·81	4·21	35·73	31·26
Hamilton	2·85	12	0·49	4·11	30·72	33·11
Rotorua	4·54	13	1·18	4·91	36·64	36·76
Kawhia	2·64	16	0·33	4·63	33·25	36·18
New Plymouth ..	6·19	19	1·07	5·46	37·52	40·31
Riversdale, Inglewood ..	8·69	19	1·54	8·89	56·18	67·60
Whangamomona ..	6·28	12	1·20	6·02	43·94	48·99
Hawera	3·71	13	0·82	4·50	28·21	30·11
Tairua	6·95	16	1·41	5·84	40·69	45·71
Tauranga	7·50	15	1·90	4·20	40·96	35·95
Maraehako Station, Opotiki	5·68	11	1·96	5·49	33·29	37·73
Gisborne	2·61	11	1·57	4·33	20·09	34·29
Taupo	3·71	15	1·29	4·07	29·58	29·30
Napier	2·21	10	1·06	3·45	20·91	25·97
Hastings	1·89	10	0·56	3·13	17·77	23·42
Whakarara Station ..	2·05	7	0·62	..	33·78	..
Taihape	1·88	12	0·85	2·78	29·94	23·47
Masterton	4·49	13	1·20	3·61	24·95	26·64
Patea	3·52	15	0·68	3·81	27·62	29·44
Wanganui	2·76	14	0·65	2·81	23·80	23·85
Foxton	2·68	16	0·60	2·95	23·13	21·33
Wellington	5·15	20	1·39	3·82	32·07	28·82
	South Island.					
Westport	9·06	21	2·91	7·70	63·47	62·50
Greymouth	10·18	23	1·57	7·48	66·54	64·97
Hokitika	11·85	23	3·33	9·19	67·26	73·09
Ross	14·15	14	2·75	10·43	83·15	82·38
Arthur's Pass ..	24·50	12	4·15	10·20	109·73	96·07
Okuru, South Westland	15·72	15	2·73	11·24	..	93·80
Collingwood	17·27	17	3·61	7·11	67·96	62·09
Nelson	4·58	16	1·06	3·02	25·03	24·78
Spring Creek, Blenheim	3·74	12	0·60	2·75	20·42	20·64
Seddon	2·92	16	0·55	1·90	19·26	16·62
Hanmer Springs ..	4·08	14	1·05	3·41	38·53	29·39
Highfield, Waiau ..	3·53	10	0·98	2·45	26·80	22·53
Gore Bay	4·47	10	1·60	2·64	29·07	21·31
Christchurch	3·11	11	1·18	1·86	20·92	17·46
Timaru	1·00	10	0·27	1·47	18·68	14·43
Lambrook Station, Fairlie	1·87	11	0·48	1·53	20·45	16·13
Benmore Station, Clearburn	2·08	17	0·76	1·48	16·64	16·02
Oamaru	1·61	8	0·59	1·74	16·44	14·44
Queenstown	4·18	14	1·18	1·95	22·74	19·25
Clyde	0·94	8	0·31	0·79	13·31	9·45
Dunedin	4·59	13	2·50	3·07	29·17	24·20
Wendon	1·99	9	0·41	2·05	20·53	19·27
Balclutha	2·55	11	0·95	1·78	24·54	16·27
Invercargill	2·45	15	0·55	3·22	28·91	29·67
Puysegur Point ..	7·52	21	1·11	6·94	48·54	55·35
Half-moon Bay ..	4·01	15	1·24	4·39	33·11	37·92

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HEDGES FOR MILD CLIMATE.

S. E. W., Te Puke :—

Please supply information about suitable hedges for this district. We get a fair amount of frost and some fairly heavy winds also; are situated about 1½ miles from the coast. I want a hedge for around the house and garden, say, about 4ft. to 6 ft. high, evergreen, and ornamental if possible.

The Horticulture Division :—

The selection of an evergreen and ornamental hedge for around the house and garden is very much a matter of taste. *Abelia floribunda* has the necessary qualities, but is perhaps hardly sufficiently vigorous for your conditions. *Cupressus Lawsoniana* planted 3 ft. apart on the weather side and *Escallonia exoniensis* planted alternately 1 ft. apart with *Tecoma Capensis* on the remaining boundaries would be both ornamental and evergreen. The weather in your locality is comparatively mild, so that it need not limit your selection of any of the hedge plants offered for sale.

RAISING SEEDLINGS FOR SHELTER.

R. B., Heathcote Valley, Christchurch :—

Please advise me—(1) The best variety of pinus seed or macrocarpa seed suitable for a market-gardener to use as shelter-belts on a hillside; (2) right time to sow and the best method for sowing; (3) when the plants should be ready for planting into the permanent position after sowing the seed.

The Horticulture Division :—

The species of pine that is probably most suitable for the purpose is *Pinus muricata;* it is usually more compact and better furnished at the base than other species commonly planted. The pine and *Cupressus macrocarpa* seed should be sown in boxes or in wide drills outside during the month of October, and kept shaded until the seeds germinate. Seedlings grown outside will require wrenching during moist autumn weather; wrenching is done by inserting a bright, sharp spade down each side of a row of plants in such a way that the roots are pruned of about one-third of their growth, and the soil tramped firm after the operation. Under good conditions the seedlings will be large enough for planting out during the following winter.

CROPS FOR PIGS IN NORTHERN DISTRICTS.

D. L. S., Cambridge :—

I desire information regarding the growing of soya bean or any other cereals that might be suitable for pig-feeding.

The Fields Division :—

Soya beans require for best results a climate suitable for maize-growing—*i.e.*, one free from frosts during full growing period. For several years soya beans were grown in the vicinity of Hamilton, but the yields were disappointing. Higher yields were obtained from ordinary Canadian Wonder garden beans, the cultivation and treatment of which is similar to that required for soya beans. Black skinless barley does fairly well on the undulating loamy soils of the Waikato, but is generally a failure on sandy pumice and peat flats. It is not known whether any cereal can be grown economically for pig-feeding in the Waikato and probably feeding for fattening on skim-milk, meat-meal, and grass and wintering sows on grass, roots, and meat-meal is the best practice.

CURING BACON.

P. W., Mangapehi :—

Please supply me with your recipe for baconing pigs.

The Live-stock Division :—

In brine curing all that is required is to pack the properly cooled meat into a clean barrel or trough and pour over this a prepared brine. For successful curing a cool damp cellar is best. Weigh out for every 100 lb. of meat, 8 lb. salt, 2 lb. sugar, and 2 oz. saltpetre. Dissolve all the ingredients in 4 gallons water and cover the meat with the brine. Make the brine a day before it is used. Bacon strips remain in from four to six weeks, and hams from five to eight weeks according to size. Any fermentation or ropiness can be checked by the addition of a small amount of baking-soda, by reboiling, or making a new brine.

DIFFICULT BREATHING IN PONY.

R. P. S., Opotiki :—

A pony mare that was very fat and running with other horses has developed a difficulty in her breathing, heaving heavily to get her breath even when standing still. She can eat, drink, and neigh. Since the trouble came on (four months ago) she has lost condition and looks as though she will die. Do you think she may have been kicked in the wind-pipe ?

The Live-stock Division :—

Probably she is suffering from broken wind which clearly resembles asthma in the human subject. Give her about two tablespoonfuls of raw linseed-oil daily in her feed. There is no specific cure for this disease.

HOREHOUND ON SHEEP GRASSLAND.

G. D., Taihape :—

I have a patch of horehound on a steep face on my property, and am writing to ask you to let me know the best way to eradicate same. The patch has been there for some years and I have pulled it, but it is spreading. The face is too steep to get cattle on, and to-day the soil is very free and crumbling down, consequently no grass is left. If I use sodium chlorate would it be necessary to empty stock out of paddock ?

The Fields Division :—

Like all other undesirable weeds in pasture, horehound indicates a weakening or opening-up of the sward, and suppression can be obtained only by strengthening or stimulating the pasture to such an extent that it will successfully compete with such weeds. To eradicate horehound, which has a woolly leaf, it would be preferable to dry-dust it with sodium chlorate rather than to spray. It would be advisable to mix thoroughly sodium chlorate, 1 part to 10 or 12 parts sand or carbonate of lime, and dust the horehound fairly heavily. There is no need to shift stock from the area. Next spring it would be well to sow broadcast with a mixture of—*Lotus major*, ½ lb. ; browntop, 3 lb. ; *Danthonia pilosa*, 6 lb. ; crested dogstail, 4 lb. : total, 13½ lb. an acre. It would be advisable to apply superphosphate at the rate of 3 cwt. per acre, and drive a mob of sheep over the ground to thoroughly cover the seed and consolidate the ground.

PAMPAS GRASS AND TOETOE COMPARED.

W. T. B., Paengaroa :—

Is the pampas grass described in the May *Journal* the imported variety or our native kakahou ?

The Chief Chemist :—

Pampas grass, although similar in growth form to the native toetoe (*Arundo conspicua*), for which another name is Kakaho, is an entirely distinct species, of taller growth, and having a denser flowering plume. The pampas grass has a leaf which can be easily broken, whereas the Kakaho has an extremely fibrous leaf difficult to break.